TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

HEARINGS
BEFORE THE
SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-EIGHTH CONGRESS
FIRST SESSION

JULY 12, 21, 1983

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CONTENTS

WITNESSES

Page

July 12, 1983:
- Hon. Spark Matsunaga, a U.S. Senator from the State of Hawaii 7
- Michael S. Koleda, president, National Council on Synthetic Fuels Production, accompanied by Edward Miller, vice president for finance, U.S. Synthetic Fuels Corporation; and Dr. Joel Weiss, chairman, government relations committee, Solar Energy Industries Association 23

July 21, 1983:
- Dr. Lawrence T. Papay, senior vice president, Southern California Edison Co.; Dr. Bennett Miller, vice president, energy program, Fred C. Hart Associates, Inc.; Michael J. Zimmer, general counsel, Cogeneration Coalition, Inc.; Dr. Alan P. Magerman, chairman of the board, Omnimax, Inc., accompanied by Dr. Harry A. Beale, director of research, U.S. Energy Resources, Inc 70
- Peter B. Bos, president, Polydyne, Inc., Menlo Park, California; Joseph M. Schell, vice president, Kidder, Peabody & Co., Inc., New York, N.Y.; and William H. Babcock, senior associate, Booz, Allen & Hamilton, Bethesda, Md 158

Appendix—Additional statements submitted for the record 273

TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

TUESDAY, JULY 12, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Energy Development and Applications,
Washington, D.C.

The committee met, pursuant to notice, at 11:34 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the subcommittee) presiding.

Present: Representatives Young, Nelson, Durbin, Sensenbrenner, Bateman, Lewis and Schneider.

Staff present: Eugene Frankel, Ezra Heitowit, Brenda Ali, and Don Steinway.

Mr. **Young**. The Subcommittee on Energy Development and Applications will come to order. The chairman, I understand, is on his way, so, without objection, his opening statement will be made a part of the record.

[The opening statement of Mr. Fuqua follows:]

OPENING STATEMENT
OF THE
HONORABLE DON FUQUA (D-FLA.)
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
HEARING ON
TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES
JULY 12, 1983

IT GIVES ME GREAT PLEASURE TO WELCOME OUR WITNESSES, GUESTS AND COLLEAGUES TO TODAY'S HEARING ON TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES.

LAST YEAR, ON ALMOST THIS VERY DATE, WE HELD A HEARING ON BUSINESS INCENTIVES FOR RENEWABLE TECHNOLOGIES. AT THAT HEARING WE LOOKED AT THE IMPACTS OF EXTENDING THE SOLAR BUSINESS TAX CREDITS NOW IN PLACE FOR ANOTHER FIVE YEARS. WE RECEIVED EXCELLENT TESTIMONY

FROM A VARIETY OF PRIVATE SECTOR SOURCES ALL SUPPORTING THE EXTENSION OF THOSE TAX CREDITS.

BASED ON THAT TESTIMONY, MR. LUJAN AND I INTRODUCED H.R. 1775, A BILL TO EXTEND THE SOLAR BUSINESS TAX CREDITS TO 1990 AND ENHANCE THEIR VALUE TO 25 PERCENT. WE INTRODUCED THAT BILL IN FEBRUARY OF THIS YEAR.

SINCE THAT TIME A GREAT DEAL HAS HAPPENED. SENATORS PACKWOOD AND MATSUNAGA INTRODUCED S. 1305, LEGISLATION TO EXTEND ALMOST ALL OF THE RENEWABLE ENERGY TAX CREDITS - BIOMASS COGENERATION, SMALL HYDROPOWER AND RESIDENTIAL SOLAR - TO 1990. MR. HEFTEL INTRODUCED SIMILAR LEGISLATION, H.R. 3072, WHICH I HAVE THE HONOR TO CO-SPONSOR.

FINALLY, SENATOR DOMENICI RECENTLY PROPOSED LEGISLATION, S. 1396, WHICH WOULD PROVIDE AN AFFIRMATIVE COMMITMENTS CLAUSE FOR SOLAR PROJECTS, AND WOULD EXTEND THE EXISTING AFFIRMATIVE COMMITMENT CLAUSE FOR THE SYNFUELS TAX CREDITS TO DECEMBER 31, 1987.

BECAUSE OF ALL THIS ACTIVITY IT SEEMS APPROPRIATE FOR THE EDA SUBCOMMITTEE TO REVISIT THE ISSUE OF TAX CREDITS FOR NEW ENERGY TECHNOLOGIES. THIS TIME WE WISH TO BROADEN OUR INQUIRY TO INCLUDE TECHNOLOGIES THAT ARE NOT IN H.R. 1775, SUCH AS BIOMASS, COGENERATION, AND SYNTHETIC FUELS. WE ALSO WISH TO LOOK AT THE RESULTS OF RECENT STUDIES OF THE TAX CREDIT ISSUE.

OUR FIRST WITNESS TODAY IS ONE OF THE TRUE CHAMPIONS OF RENEWABLE TECHNOLOGIES IN THE CONGRESS, AND A CO-SPONSOR OF ONE OF THE MAJOR PIECES OF TAX CREDIT LEGISLATION BEING CONSIDERED BY CONGRESS THIS YEAR. IT GIVES ME GREAT PLEASURE TO WELCOME SENATOR SPARK MATSUNAGA TO THE EDA SUBCOMMITTEE.

Mr. YOUNG. Mr. Sensenbrenner, would you like to make the same sort of request?

Mr. SENSENBRENNER. Yes; I have an opening statement that is very brief, and I appreciate the opportunity to extend a welcome to our distinguished witnesses, particularly to the Senator from Hawaii.

We look forward to their testimony on the effectiveness of existing tax incentives for promoting the development of new energy technologies, and the need to extend those tax incentives beyond their expiration date.

The initial development of new energy technologies requires the expenditure of substantial capital resources. These resources may be obtained either through direct public funding through grants, loans, or direct aid by the Federal Government, or through the private sector's funding of these projects. The private sector's funding of these projects may be stimulated through tax incentives.

I look forward to the witnesses' thoughts on the impact of these incentives upon our economy and their effectiveness in developing new technologies. I yield back the balance of my time.

[The opening statement of Mr. Sensenbrenner follows:]

STATEMENT OF THE HONORABLE
F. JAMES SENSENBRENNER, JR. (R-WIS.)

EDA SUBCOMMITTEE HEARING ON TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

JULY 12, 1983

THANK YOU, MR. CHAIRMAN, FOR THIS OPPORTUNITY TO EXTEND A WELCOME TO OUR DISTINGUISHED WITNESSES.

WE LOOK FORWARD TO THEIR TESTIMONY ON THE EFFECTIVENESS OF EXISTING TAX INCENTIVES FOR PROMOTING THE DEVELOPMENT OF NEW ENERGY TECHNOLOGIES AND THE NEED TO EXTEND THOSE TAX INCENTIVES BEYOND THEIR EXPIRATION DATE.

THE INITIAL DEVELOPMENT OF NEW ENERGY TECHNOLOGIES REQUIRES THE EXPENDITURE OF SUBSTANTIAL CAPITAL RESOURCEAS. THESE RESOURCES MAY BE OBTAINED EITHER THROUGH DIRECT PUBLIC FUNDING, THROUGH GRANTS, LOANS OR DIRECT AID BY THE FEDERAL GOVERNMENT, OR THROUGH THE PRIVATE SECTOR'S FUNDING OF THESE PROJECTS. THE PRIVATE SECTOR'S FUNDING OF THESE PROJECTS MAY BE STIMULATED THROUGH TAX INCENTIVES. I LOOK FORWARD TO THE WITNESS' THOUGHTS ON THE IMPACT OF THESE INCENTIVES UPON OUR ECONOMY, AND THEIR EFFECTIVENESS IN DEVELOPING NEW TECHNOLOGIES.

Mr. Young. Thank you very much.

I look forward to the testimony of the gentlemen today regarding tax incentives for new energy technologies. Over the past few months I have watched the treatment of energy issues in the press and in Congress and it leaves me a bit uneasy to see alternate energy technologies placed on a back burner when, in fact, they should be moving full steam ahead.

In today's market, the oil prices are low and will probably drop through 1986. In times like this it scares me to see the United States sit back with a sense of security over current conditions when these conditions are, at best, temporary. Recent projections in the DOE's annual energy outlook show oil prices rising again through the 1990's from $36 to $50 a barrel in 1982 dollars.

Our reliance on imported oil will once again increase from a present-day reliance of approximately 4.2 million barrels a day to a projected 9.5 million barrels a day in 1990. it is no secret that the instability in the Mideast, accompanied by tightening world oil markets leaves a shaky situation in the United States if we continue to rely heavily on imports for our energy needs.

Clearly, the answer is to continue our research and production in the exciting areas of synthetic fuels, solar, geothermal, wind, and ocean thermal energies, to name a few. In Congress we should continue our efforts to stimulate these technologies. In the past, tax incentives have aided these industries in capital formation and covering expenses, so that the new, viable technologies can put more money into the economy, provide jobs, and meet our real energy needs.

Once again, gentlemen, I look forward to you and your associates' testimony about the current needs of our technological industries.

Our first witness today is one of the true champions of renewable technologies in the Congress, and a cosponsor of one of the major pieces of tax legislation being considered by Congress this year. It gives me a great pleasure to welcome Senator Matsunaga to the EDA subcommittee. Senator, we know your time is limited, so whatever you care to do, proceed. Your full statement will be made a part of the record, without objection.

STATEMENT OF HON. SPARK MATSUNAGA, A U.S. SENATOR FROM THE STATE OF HAWAII

Senator Matsunaga. Thank you, Mr. Chairman, and members of the subcommittee for this opportunity to testify in support of tax incentives for the development and commercialization of renewable energy.

Just to make sure that there is no misunderstanding as to where I stand, let me at the very outset admit that I am an avid supporter of the development of renewable energy and a staunch advocate of Government support for the development of renewable energy technologies.

In part, this is because my home State of Hawaii, of all the 50 States of the Union, is the most vulnerable to disruption of its nonrenewable petroleum supply. We, in Hawaii, live in a chain of islands separated from the mainland United States by distance and time. As a matter of fact, I just returned from Hawaii and still feel the effects of jet lag, and if you know the classic definition of jet lag, you know how I feel. And that classic definition is that it is a confused state of your physiopsychological system wherein you become hungry at bedtime and sexy at lunchtime.

Jet fuel for air transportation and bunker fuel for marine transportation are virtual necessities for every part of Hawaii's economy and society. All of our gasoline, and the oil used to generate most of our electricity must be shipped over great distances, and most of it comes from foreign sources.

The oil embargo of 1974 and the rapid escalation of oil prices which followed, dramatically and painfully demonstrated to the people of Hawaii that total dependence on foreign sources for their energy supply must be brought to an end. As a consequence, considerable attention by both public officials and businessmen was focused on the development of indigenous sources of energy. Its urgency and need were fully recognized. What role the Government should play was the issue. Because of the awesome challenge, with its potential of great benefits to the State, it was generally agreed that the task must be undertaken as a joint venture between government and private industry.

Accordingly, the State government of Hawaii assumed the major role in the research and development of geothermal energy on State-owned land in Puna, Hawaii, and, with Federal funding assistance, proved the feasibility of its commercialization. The private sector has been convinced and has undertaken its own projects at its own risk since then. I hasten to add that had it not been for the incentives provided in the Energy Tax Act of 1978 and the Crude Oil Equalization Tax Act of 1980, private industry may not have been moved to do so.

Hawaii businesses and industries have substantially increased their reliance on renewable energy resources for the generation of electricity and the creation of process steam in recent years. For example, on the big island where it was just a few years ago zero electricity generated by the burning of sugarcane wastes, normally referred to bagasse, today it is up to 41 percent of the total produced on that island. And, on my home island of Kawi, from zero in just less than 5 years to 56 percent of the electricity being generated by burning of sugarcane waste and wood chips, primarily eucalyptus.

During this same period, residents of Hawaii have been purchasing solar hot-water heating systems and domestic photovoltaic systems in increasing numbers, to reduce the consumption of electricity produced by oil. The motivation in both instances has been provided not only by the high price of oil, but also, perhaps to a greater degree, by State and Federal tax incentives.

Another important fact of life for Hawaii's citizens is that Hawaii is not connected to any interstate utility grid. We cannot take advantage of the economies of scale and the potential for selling electricity between large utilities that can be done on the mainland. The separate islands of Hawaii are not interconnected with powerlines, although we hope to interconnect our islands within the next few years. But even then, our islands together would not constitute a system large enough to support even a single commercial-scale nuclear power plant.

However, Hawaii is blessed more abundantly with renewable energy resources than any other State, in proportion to its needs. We have the Sun, which shines on our fair State all year round, providing us with the opportunity to displace foreign oil with residential solar hot water heaters, solar thermal electric generators, photovoltaic systems, and other forms of direct use of sunlight to provide energy. The same sunlight insures that our crops will grow steadily, providing our islands with abundant biomass resources in the form of bagasse—the waste matter of sugarcane production—and eucalyptus trees, a fast-growing woody crop which is currently being developed as a potential source of energy to displace oil for the generation of electricity and for process heat.

Our island State also provides a multitude of excellent sites for generation of electricity from windpower. The northeast trade winds, which blow across Hawaii 75 percent of the time represent one of the world's most consistent and reliable wind patterns. These tradewinds have attracted a number of wind energy developers to plan and begin development of windfarms as a source of electricity. The Hawaiian Electric Co. recently completed a 2-year demonstration of the Department of Energy's Mod-OA wind generator, a 200-kilowatt unit that produced a total of 1.7 million kilowatt-hours of electricity over a period of two years at Kahuku on the island of Oahu.

The success of this machine has encouraged Hawaiian Electric Co. to sign a contract with the General Electric Co. to purchase the first of a new generation of larger wind machines, the 7-megawatt Mod-5A, which will be put into service not far from the site where the 200-kilowatt machine was located. This installation will not be a fully commercial operation, however. It is a demonstration project to test the durability and the cost-effectiveness of this new, large wind generator, the first of its kind.

This is an important point to emphasize. While this machine is a commercially sized generator, capable of being replicated into a large windfarm, it is only the very first production model, and thus is a high-cost item. Its construction involves a certain degree of risk, and even if highly successful in a technical sense, its high cost as the first of its kind may not allow it to be economical.

But the potential for such machines in Hawaii is vast. According to a report by the Hawaii Natural Energy Institute, the capacity to generate wind energy on the islands of Hawaii is far greater than our demand. In 1979, all the islands of Hawaii together consumed 6.2 billion kilowatt-hours of electricity. By comparison, the average energy potential of available wind sites ranges from a low of 27.2 billion kilowatt-hours to a high of 131 billion kilowatt-hours.

Another form of energy available to Hawaii is ocean thermal energy conversion, OTEC, the sunlight trapped as heat in the upper layers of the ocean. Just a few weeks ago, the U.S. Department of Energy awarded a contract to a New York-based firm, Ocean Energy Corp., for the second phase in the development of a commercial-sized OTEC system in Hawaii. Ocean Thermal Corp. and the Ocean Energy Council have informed me that, with the appropriate incentives, they have every confidence that OTEC can be an important source of electricity for the island of Oahu within the next 10 to 15 years.

In addition, some of our islands have abundant water resources which can be tapped to provide low-head hydroelectric power.

So, Mr. Chairman, as you can readily understand, we have wonderfully abundant renewable energy resources in Hawaii. For this reason I sometimes like to refer to Hawaii as America's natural energy laboratory. For this same reason, I believe that Hawaii can one day become the first State in the Nation to be self-sufficient in domestically produced renewable alternative energy.

My confidence in saying this, Mr. Chairman, is in part due to the potential for using our abundant OTEC, wind, and geothermal energy resources to generate surplus electricity which can be used to produce hydrogen fuel from water. As you know, the technology for liquifying hydrogen has been developed and liquid hydrogen has been proven to be the safest, cleanest burning fuel for air and land transportation, and a good source of electricity for peak-usage hours. Moreover, work is underway to perfect a high-efficiency hydrogen-air battery, which may be the source of stored electricity for both large-scale and small-scale uses.

However, I wish to take pains to emphasize, Mr. Chairman, that most of the technologies needed to tap these abundant source of domestic, environmentally pure, and inexhaustible energy are still under development. The up-front expenditures required to bring commercial systems online are enormous for all of these technologies, and the leadtimes vary from a few years to two decades or more for some technologies.

Mr. Chairman, one of the questions to which this subcommittee seeks answers is whether or not tax credits actually have an effect on the development and commercialization of renewable energy. Admittedly, our experience with tax credits for renewable energy is very short. However, I have seen what I think is fairly compelling evidence that the tax credits have become critical factors in these investment decisions, and are likely to remain so over the next several years at least. The existence of these credits encourages those with money to invest in renewable energy development as opposed to other investments which might have shorter lead times.

One such bit of evidence is the number of purchases of solar energy systems by both individuals and businesses in Hawaii. The State of Hawaii has accurate records beginning with 1977, the year before the Energy Tax Act was enacted, because Hawaii enacted its own tax credit legislation in 1976. These records show that 1,101 Hawaii taxpayers claimed a credit for installation of a solar energy device in 1977. Then, in 1978, the first year for which a person or company could claim the solar tax credit, the number of purchases more than tripled, to 4,061. In the following year, the number of Hawaii citizens and firms claiming the credit increased to 4,375, and in 1980, the number rose to 4,704.

Additional evidence was provided to me by the Ocean Energy Council, the organization representing firms involved in the development of OTEC. After polling its members, the Ocean Energy Council concluded that the extension of the credit for OTEC through the year 1995, plus an increase in the credit from 15 percent to 20 percent, would have the effect of stimulating $785 million in domestic OTEC sales. At the same time, the council concluded that if the credit is terminated in 1985, before it could be used for any OTEC system, sales of OTEC would promptly drop to zero.

In other words, for OTEC at least, the credit is a critical link in the financial viability of every single project.

However, the most compelling evidence I have seen of the importance of credits came to me through a personal glimpse into a single project. In this case, a group of investors from New Jersey and New York were planning to build an 80-megawatt wind farm in Hawaii and sell its electricity to the local utility company. When the Reagan administration announced that it intended to seek repeal of the existing credits before 1985, these investors immediately pulled out of the project. Although Congress, primarily through your leadership, Mr. Chairman, succeeded in retaining the credits, despite the administration's position, it was too late to save this particular alternative energy project in Hawaii.

In short, Mr. Chairman, what I am trying to say is that the future of large scale and business-use renewable energy systems would be extremely bleak in the absence of incentives in the form of energy tax credits in Hawaii or in any other State. I cite the experience in Hawaii only because of my familiarity with it, but I am sure other States must be undergoing similar experiences.

In my humble opinion, Mr. Chairman and members of the subcommittee, this assessment is reinforced by the current conditions in the world oil market. The price of oil has taken a temporary dip, and there are optimistic rumors of further declines in the price of oil—perhaps to $25 a barrel, some say.

Mr. Chairman, $25 a barrel is not my idea of cheap oil, nor is it my idea of a cost that Americans should continue to bear forever for an imported resource when domestic alternatives, providing domestic jobs, are readily available. However, the temporary slackening off of the spiral of increases in oil prices has had its psychological effects on investors and buyers. With the Nation in a frame of mind to think that we do not have to worry about the price of petroleum, it is doubly important that the tax credit be retained as an incentive to both developers and buyers to continue investing in renewable energy systems. It is important also that the Congress retain the credit for its value as a signal to investors that we know the future is not a future of cheaper oil.

Mr. Chairman, I realize I have taken much more time than I should have. I have the written statement before you outlining the bill which Senator Packwood and I, along with several additional cosponsors, have introduced in the Senate, the so-called Renewable Energy Tax Incentives Act of 1983. And I lay out the principal provisions of that bill, which I will skip at this point.

And in response to your request for comments on the appropriate levels of tax incentives to insure the development of viable alternative energy industries and the appropriate termination date for the business tax credits, I strongly suggest that the levels of credits provided for in the Senate bill are the appropriate levels, and that the termination dates are also appropriate for your consideration.

Now, to conclude my testimony, Mr. Chairman, I wish to reiterate my strong belief that the development of renewable energy is a vital and necessary part of the future of our Nation as a whole, just as it is critical for the future of Hawaii. In the long run, due to the high cost of oil and the volatility of world oil supplies, renewable energy will become the most economical and secure source of energy available to our Nation. In keeping with the prevailing view that management and labor in the private sector, and government at the local, State, and Federal levels must all work together in order to revive our economy and restore our Nation to its rightful position as the world's leader in business and industry the least we public servants can do is to provide the private entrepeneurs with incentives to do what needs to be done.

Thank you very much.

[The prepared statement of Senator Matsunaga follows:]

"TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES"
STATEMENT BY SENATOR SPARK MATSUNAGA
BEFORE THE SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS,
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. House of Representatives
2318 Rayburn House Office Building
Tuesday, July 12, 1983

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Just to make sure that there is no misunderstanding as to where I stand, let me at the very outset admit that I am an avid supporter of the development of renewable energy, and a staunch advocate of government support for the development of renewable energy technologies. In part, this is because my home State of Hawaii, of all the fifty states in the Union, is the most vulnerable to disruption of its non-renewable petroleum supply. We in Hawaii live on a chain of islands, separated from the mainland United States by distance and time. Jet fuel for air transportation and bunker fuel for marine transportation are virtual necessities for every part of Hawaii's economy and society. All of our gasoline, and the oil used to generate most of our electricity must be shipped great distances, and most of it comes from foreign sources.

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My confidence in saying this, Mr. Chairman, is, in part, due to the potential for using our abundant OTEC, wind, and geothermal energy resources to generate surplus electricity which can be used to produce hydrogen fuel from water. As you know, the technology for liquifying hydrogen has been developed and liquid hydrogen has been proven to be the safest, cleanest burning fuel for air and land transportation, and a good source of electricity for peak usage hours. Moreover, work is under way to perfect a high-efficiency hydrogen-air battery, which may be the source of stored electricity for both large-scale and small-scale uses.

However, I wish to take pains to emphasize, Mr. Chairman, that most of the technologies needed to tap these abundant sources of domestic, environmentally pure, and inexhaustible energy are still under development. The up-front expenditures required to bring commercial systems on line are enormous for all of these technologies, and the lead times vary from a few years to two decades or more for some technologies.

Mr. Chairman, one of the questions to which this subcommittee seeks answers is whether or not tax credits actually have an effect on the development and commercialization of renewable energy. Admittedly, our experience with tax credits for renewable energy is very short. However, I have seen what I think is fairly compelling evidence that the tax credits have become critical factors in these investment decisions, and are likely to remain so over the next several years at least. The existence of these credits encourages those with money to invest in renewable energy development, as opposed to other investments which might have shorter lead times.

One such bit of evidence is the number of purchases of solar energy systems by both individuals and businesses in Hawaii. The State of Hawaii has accurate records beginning with 1977, the year before the Energy Tax Act was enacted, because Hawaii enacted its own tax credit legislation in 1976. These records show that 1,101 Hawaii taxpayers claimed a credit for installation of a solar energy device in 1977. Then, in 1978, the first year for which a person or company could claim the solar tax credit, the number of purchases more than tripled, to 4,061. In the following year, the number of Hawaii citizens and firms claiming the credit increased to 4,375, and in 1980, the number rose to 4,704.

Additional evidence was provided to me by the Ocean Energy Council, the organization representing firms involved in the development of OTEC. After polling its members, the Ocean Energy Council concluded that the extention of the credit for OTEC through the year 1995, plus an increase in the credit from 15 percent to 20 percent, would have the effect of stimulating $785 million in domestic OTEC sales. At the same time, the Council concluded that if the credit is terminated in 1985, before it could be used for any OTEC system, sales of OTEC would probably drop to zero.

In other words, for OTEC at least, the credit is a critical link in the financial viability of every single project.

However, the most compelling evidence I have seen of the importance of the credits came to me through a personal glimpse into a single project. In this case, a group of investors from New Jersey and New York were planning to build an 80-megawatt wind farm in Hawaii and sell its electricity to the local utility company. When the Reagan Administration announced that it intended to seek repeal of the existing credits before 1985, these investors immediately pulled out of the project. Although Congress, primarily through your leadership, Mr. Chairman, succeeded in retaining the credits, despite the Administration's position, it was too late to save this particular alternative energy project in Hawaii.

In short, Mr. Chairman, what I'm trying to say is that the future of large-scale and business-use renewable energy systems would be extremely bleak in the absence of incentives in the form of energy tax credits in Hawaii or in any other state. I cite the experience in Hawaii only because of my familiarity with it, but I'm sure other states must be undergoing similar experiences. In my humble opinion, this assessment is reinforced by the current conditions in the world oil market. The price of oil has taken a temporary dip, and there are optimistic rumors of further declines in the price of oil -- perhaps to $25 a barrel, some say.

Mr. Chairman, $25 a barrel is not my idea of cheap oil, nor is it my idea of a cost that Americans should continue to bear forever for an imported resource when domestic alternatives, providing domestic jobs, are readily available. However, the temporary slackening off of the spiral of increases in oil prices has had its psychological effects on investors and buyers. With the nation in a frame of mind to think that we do not have to worry about the price of petroleum, it is doubly important that the tax credit be retained as an incentive to both developers and buyers to continue investing in renewable energy systems. It is important also that the Congress retain the credit for its value as a signal to investors that we know the future is not a future of cheaper oil.

For these reasons, Mr. Chairman, Senator Bob Packwood and I, with several additional cosponsors, introduced the "Renewable Energy Tax Incentive Act of 1983," a bill to extend and enhance the renewable energy credits for individuals and businesses. The major provisions of this bill are:

1. It extends the 40 percent residential solar, wind, and geothermal tax credit from December 31, 1985, to December 31, 1990.

2. It increases the business and industrial solar, wind and geothermal tax credit from 15 percent to 25 percent on July 1, 1983, and extends these credits to December 31, 1990.

3. It increases the current ocean thermal tax credit from 15 percent to 25 percent and extends these credits to December 31, 1990.

4. It extends the 10 percent business and industrial biomass credit from December 31, 1985 to December 31, 1990.

5. It extends the 10 percent business and industrial cogeneration tax credit from December 31, 1982, to December 31, 1990.

6. It extends the 11 percent hydroelectric tax credit from January 1, 1980 to December 31, 1990.

7. It provides for an affirmative commitment rule for certain energy property. Under this rule, business or industrial solar, wind, geothermal, ocean thermal, biomass and cogeneration projects

begun by December 31, 1990 would continue to be eligible for tax credits until December 31, 1995, if certain conditions are met.

8. It eliminates the 20 percent limitation for oil and natural gas used in cogeneration facilities.

9. And finally, it changes the investment tax credit for certain energy property. Currently, the IRS denies the regular 10 percent investment tax credit to most solar, wind, and geothermal air or water heating or cooling systems because it seems this equipment is "structural". The bill eliminates this rule for solar, wind and geothermal property.

Mr. Chairman, in response to your request for comments on the appropriate levels of tax incentives to ensure the development of viable alternative energy industries, and the appropriate termination date for the business tax credits, I strongly suggest that the levels of credits provided for in the Senate bill are the appropriate levels. As I mentioned earlier, the bill increases the solar, wind, OTEC, and geothermal tax credit for businesses from 15 percent to 25 percent, effective July 1, 1983. The purpose of this increase is partly to offset an Internal Revenue Service action denying the regular 10 percent investment tax credit for many solar, wind, and geothermal heating and cooling systems on grounds that these systems are "structural" rather than "equipment." For OTEC investments, the increase from 15 percent to 25 percent is to offset the long lead times involved in OTEC investments and the uncertainties created in the minds of investors by short-term, downward fluctuations in the price of oil, the major competing energy source.

Regarding the appropriate termination dates for these credits, Mr. Chairman, my own personal view is that it is too early to say. Research, development and commercialization of new technologies are not simple actions; they are time-consuming processes involving chains of interrelated development and investment decisions, first by producers and then by purchasers. I believe the termination date of 1990, with an affirmative commitment rule extending the termination date through the end of 1995 for systems with long lead times, provides sufficient time for today's renewable energy entrepreneurs to make business decisions with a reasonable level of certainty on at least one financial issue, that of their tax status. However, I believe also that this issue merits review again before the credits expire, so that the Congress may again consider whether or not continued or additional incentives are warranted.

To conclude my testimony, Mr. Chairman, I wish to reiterate my strong belief that the development of renewable energy is a vital and necessary part of the future of our Nation as a whole, just as it is critical to the future of Hawaii. In the long run, due to the high cost of oil and the volatility of world oil supplies, renewable energy will become the most economical and secure source of energy available to our Nation.

In keeping with the prevailing view that management and labor in the private sector, and government at the local, state and federal levels, must all work together in order to revive our economy and restore our Nation to its rightful position as the world's leader in business and industry, the least we public servants can do is to provide the private entrepeneurs with incentives to do what needs to be done.

Thank you for listening.

Mr. YOUNG. Thank you very much, Senator. Without objection your full statement has been entered as a part of the record.

I have just one question. In the current political climate, with everyone talking about raising revenues, how do you think it will be possible to pass a revenue-reducing measure such as your bill?

Senator MATSUNAGA. That is a good question, Mr. Chairman, because that is, in fact, not the case. In the case of providing incentives, the Federal revenues will not be reduced but in fact will be enhanced, because we are not taking away anything from what is going on. Unless private industry invests and enlarges its existing businesses or enters upon new businesses, the tax credits would not be available.

Mr. YOUNG. Very good.

Those of us from the Midwest, like Mr. Durbin and the gentlelady from Rhode Island, Mrs. Schneider, are not blessed with a great Sun, and I don't intend to referee any sort of a fight between Hawaii and Florida, but I notice our chairman has returned. And so, at this point, I would like to yield to the gentleman from Florida.

Mr. FUQUA. Thank you, Mr. Chairman. I apologize for being late, but I was running a close airline schedule this morning, and it was a few minutes late. I apologize. I don't have a question, but just want to say to my good friend and former colleague in the House that we came to Congress together many moons ago. Senator Matsunaga, we appreciate your statement and the work that you have done. I thought your statement was very excellent. I have had a chance to visit your State, and I know the very progressive role that the State of Hawaii is doing in pursuing alternative energy sources. And it is necessary, particularly in your State.

We also have—not a duplicate, but a very similar situation in my State of Florida, that is a peninsular State. While we don't have the wind advantage that you have because of the tradewinds in Hawaii, we do have a lot of OTEC that can be harnessed, and we have a lot of sunshine.

So I do want to commend you, and I hope that we can get moving in the House in getting this legislation through. I want to again thank you for your support, and taking your time to be over here today.

Senator MATSUNAGA. Thank you very much, Mr. Chairman. In fact, I made it a point to testify before your subcommittee personally because of our long association together and because of the immeasurable assistance that you, as chairman of this subcommittee, have given in the cause of development of alternative, renewable energy. And had it not been for your support, OTEC, for example, would have gone down. And it has been kept alive primarily through your efforts. I wish to express my deep appreciation and the appreciation of the people of Hawaii, because we see a great potential in OTEC.

And I thank the members of the subcommittee for lending support to the chairman.

Mr. FUQUA. Mr. Bateman.

Mr. BATEMAN. Thank you, Mr. Chairman.

Senator, I enjoyed and appreciated your statement. I thought it was an extremely well-structured one. I do have a couple of questions which do not bespeak any attitude— certainly no negative attitudes—toward tax incentives to help us achieve something that I think is important and in the national interest, and that is the development of alternative energy sources.

Has any analysis been given to whether or not tax credits or tax incentives given to the investor/developer side of the equation would be more or less effective or stimulative than tax credits given to the owner/users of alternative energy? If you had to choose between one, which does the most for your dollar?

Senator MATSUNAGA. Well, if a choice were to be made, and I say "only" in response to your question, because I believe that we should proceed in both areas, then I would choose lending tax incentives to the developers.

Mr. BATEMAN. Has there been any systematic evaluation of the revenue implications of various levels of tax incentives such as those which are outlined in your written statement? What are we looking at in terms of diminishment of revenues, if anything? I know you touched upon that generally in your statement.

Senator MATSUNAGA. As I stated earlier, there would be no diminishment of expected revenues. In fact, there would be an increase, an enhancement of revenues, because tax incentives would stimulate expansion and growth of industry.

Let me cite you an example, and it was this example which I gave in the Finance Committee which prompted the Finance Committee to adopt the tax credit back in 1978. And it was this. And it was reported by the press to some extent.

At one time macadamia nuts were unknown to Hawaii, and as you know, it is one of our——

Mr. BATEMAN. I wish they were better known to this member.

Senator MATSUNAGA. Well, the plantations were beginning to feel that they would need to convert some of the sugarlands into other agricultural products, and they came to see me. I was then chairman of the committee on public lands and also on—no, wait a minute, I am thinking of another case. When I was majority leader of the House they came to me and said:

> We will begin a new industry in Hawaii if you will allow us a tax moratorium of 8 years on real property, because it takes 8 years for the first crop to be produced after planting the seedlings.

Well, I thought it was a great thing. We certainly needed new industry in Hawaii with the growing population out there, so I said I will talk to the members of the committee. I myself was enthusiastic about it. And we accepted the proposal, gave them a tax moratorium for 8 years, and in 11 years that industry—from the time they planted the first seedlings—grew into a $3 million industry. And then, in the course of 10 years, it had developed into $17 million. Today it is up to a $27 million industry. And think of the tax base that the State now enjoys, as well as the Federal Government.

So that, I think, is a good example of what can be done with tax incentives.

And then I cited earlier about the increase in the use of bagasse for generating electricity. Well, that was being dumped into the ocean by the sugar companies. And we provided—some of you may know from serving on this subcommittee for some time—a $3 tax incentive for every barrel of oil not burned and for every amount of steam produced which would have been produced by burning a barrel of oil. But instead, by the burning of bagasse, or wood chips, they would get a $3 tax credit. And it was that incentive which motivated the sugar companies to build bagasse plants, making them into pallettes.

And I was so thrilled, over in one of the plantations managed by my good friend, Ernie Bouvier, and he invited me to look over his new system that he had. He had a conveyor belt from the sugar processing plant directly into the power generating plant, and the conveyor belt taking this waste bagasse into the burner. And he said to me, "Sparky, you know, you see all that waste matter going into that burner? That represents a savings of 40 barrels of oil per day." And that is the type of incentive we need.

Mr. BATEMAN. Senator, what are the prevailing prices of gasoline at the pump in Hawaii?

Senator MATSUNAGA. Well, it is——

Mr. BATEMAN. Higher than you find in suburban Washington?

Senator MATSUNAGA. Yes, it is higher. It is up to about $1.60. Over on the island of Molokai, now, a barrel of oil, still being used to produce electricity, costs $44.50, and the electricity there runs as high as 22 cents per kilowatt hour. That is the highest in the Nation.

Mr. BATEMAN. It certainly helps me understand your fervor for this proposition, Senator. Thank you very much.

Senator MATSUNAGA. Thank you.

Mr. YOUNG. Mr. Lewis?

Mr. LEWIS. Thank you, Mr. Chairman.

Thank you, Senator, for your excellent testimony. I certainly do laud you for your tax extensions and increases. I think they are tremendous.

In your testimony you pointed out that you are a staunch advocate of Government support for the development of renewable energy. And it has been said that we should leave the development of new energy to the free marketplace, and that the Federal Government should not become involved. Now, you also point out about joint ventures in your testimony. To what extent do you think the Federal Government should be involved in a joint venture, as well as subsidizing renewable energy resources.

Senator MATSUNAGA. One, to the extent of providing incentives, as I have outlined.

Mr. LEWIS. Which you are proposing.

Senator MATSUNAGA. And second, to undertake projects which are promising but which involve risks too great for industry itself to undertake. An example: The geothermal project in Hawaii. The risk was so great because it was unknown what was beneath the surface of that earth and how deep they would need to go. So private industry wouldn't dare to undertake it. And it was for this reason that the State itself undertook to do the job. It was a joint project at Puna between the State and the Federal Government. And that project proved so successful that since the technology was proven, private industry on its own has dug four wells in that vicinity. And there are proposals for an additional 10 wells. And that one steam well has a potential of 400 to 500 megawatts.

It was for this reason that we have applied and the Department of Energy has approved the laying of cable from the big island where we have the geothermal steam to Honolulu, where 80 percent of our population is. Because the potential is—not only is the potential great, but the feasibility has been proven to be ready for commercialization.

Mr. LEWIS. Thank you very much, Senator. One further question. Do you feel that Congress has stepped up to its responsibilities to subsidize renewable energy sources, and also to join with private industry as far as any legislation would be required in order to provide joint ventures?

Senator MATSUNAGA. We have done a lot, but I think we could do much more; we could do much more. Because, as it was said once, when the energy bill was passed, it was—as was stated by President Carter at that time—a moral equivalent of war, to go about this project of making the United States energy self-sufficient. And so long as we are dependent upon foreign oil to keep our industries running, we will never be able to control our own economic destiny.

I think this is a vital issue, and one which we, as Members of the Congress, who make the laws, must really take to heart. We must develop this Nation into a self-sufficient energy Nation.

Mr. LEWIS. Thank you, Senator, and thank you, Mr. Chairman.

Mr. YOUNG. The gentleman from Illinois, Mr. Durbin.

Mr. DURBIN. I don't have a question, Senator, but I want to tell you after spending a week in the district in 13 town meetings and hearing about natural-gas problems day in and day out, it is some comfort and relief to hear that in the State of Hawaii you are facing problems that may be even greater. I hope we can put together a coalition of people from diverse backgrounds and diverse locations to share a common concern about some of these energy challenges which we have ahead.

I appreciate your testimony this morning.

Senator MATSUNAGA. Thank you very much; and I thank you all, gentlemen.

Mr. YOUNG. The gentlelady, Mrs. Schneider.

Mrs. SCHNEIDER. Just very briefly, Senator, welcome. And I would like to ask you, in your many years of being a public servant and focusing on energy issues, what thoughts do you have on the possibility of placing greater emphasis on statewide tax credits as opposed to the Federal tax credits for renewable energy?

Senator MATSUNAGA. State tax credits should be encouraged, definitely. And Hawaii, fortunately, has led in this area. We provided tax credits even before the Federal Government provided the tax incentives. As I pointed out in my prepared statement, it was a year before the Federal Government adopted the tax credit for renewable energy that Hawaii had adopted its own law providing for such tax incentives. And I think we ourselves, as Members of the Congress, can influence the State legislators and our respective Governors to follow the suit of the Federal Government, in order that we ourselves in the Congress can be encouraged by the fact that the State is doing all it can, so the Federal Government should keep up its part of a national effort. This definitely is a national effort.

Mrs. **Schneider**. Despite our deficits?

Senator **Matsunaga**. Well, as I pointed out, it will help to eliminate our deficits. Incentives do not cause deficits. Incentives will increase revenues.

Mrs. **Schneider**. OK, thank you, Mr. Chairman.

Mr. **Young**. Well, Senator, thank you very much. We have kept you quite long this morning. We appreciate your comments, and we look forward to working very closely with you on this legislation.

Senator **Matsunaga**. Thank you again, Mr. Chairman and members of the subcommittee.

Mr. **Fuqua**. Our next group of witnesses will be Ed Miller, Vice President for Finance of the U.S. Synthetic Fuels Corporation; Dr. Joel Weiss, chairman of the Government Relations Committee of the Solar Energy Industries Association; and Michael S. Koleda, president of the National Council on Synthetic Fuels Production.

Mr. Koleda, I understand you have a time problem, so we will proceed with you first, if you wish, and we will try to wait until everyone has concluded their statements, unless someone specifically has a question for you prior to your departure time. We will try to accommodate you.

STATEMENT OF MICHAEL S. KOLEDA, PRESIDENT OF THE NATIONAL COUNCIL ON SYNTHETIC FUELS PRODUCTION, ACCOMPANIED BY EDWARD MILLER, VICE PRESIDENT FOR FINANCE, U.S. SYNTHETIC FUELS CORPORATION; AND DR. JOEL WEISS, CHAIRMAN, GOVERNMENT RELATIONS COMMITTEE, SOLAR ENERGY INDUSTRIES ASSOCIATION

Mr. **Koleda**. Well, thank you very much, Mr. Chairman. I appreciate that courtesy, if it is acceptable to everyone here.

Mr. Chairman, my formal remarks, my prepared remarks, are available for the record, and if it is all right with you and others, I will simply summarize these and perhaps add a point or two.

Mr. **Fuqua**. We will make that a part of the record, without objection.

Mr. **Koleda**. We are very grateful at the National Council on Synthetic Fuels Production trade association for companies active in synthetic fuels development. We are grateful for your interest in the issue of tax incentives for new energy technologies, and we are happy to have the opportunity to express our views today.

I might just say at the start that what we are talking about here quite simply is an analysis of what is the proper responsibility of the public sector to continue the development of an important energy technology that we need to have developed in this country for the years ahead. To what extent is the public sector responsible for continuing basically an insurance policy against a risk that the private sector cannot and does not respond to the same way the public sector should and has had a history of doing in this committee and in our experience in this country.

As you know, Mr. Chairman, under current law, the energy investment tax credit is only partially effective for synthetic fuels projects. One of the problems is that the synfuels projects are ineligible for the credit, or are eligible for it only if the sponsor has shown a so-called affirmative commitment by completing engineering studies and permit applications by the end of 1982, a date which is now, as you know, behind us.

And the plain facts, by way of background, are that the U.S. energy resource base in this country is heavily skewed toward fossil, solid fossil fuels, principally coal and oil shale. Domestic oil and gas reserves are barely holding steady despite an enormous increase in drilling activity during the past couple of years.

The United States will make, by necessity, a transition to a greater reliance on clean-burning fuels from solid resources because of the stark reality of our long-term reserve situation. Whether this transition to coal and oil shale is made deliberately as a matter of choice or whether it is achieved more frantically as a matter of necessity is up to the country.

National policy to assist the development of a U.S. synfuels production capability, through the Synthetic Fuels Corporation, and through incentives in the Tax Code, allows the United States to determine how this transition to greater reliance on solid fuels is to proceed. A failure to sustain the synfuels incentives in the face of current economic and market conditions is to relinquish control of that timetable to world politics and to the interests of oil exporting countries under conditions that will prevail in the future.

The current energy market is unsettled: we know that. The future of that market is uncertain. However, we are all hoping for and have seen the early signs of gradual economic upturn. Published articles on the future of energy prices seem to agree that gradual tightening of markets will occur; a slow resumption of real oil price increases will accompany this as economic recovery gets underway.

But tightening world oil markets and the continuing political instability of the Middle East are the unfortunate facts of life in the world's energy supply picture. The troubled Middle East still contains nearly two-thirds of the worlds proved oil reserves, and it produces almost a third of the free world's oil. It is a swing producer: when overall oil demand because of declining recession and conservation cuts into the demand for world oil, it tends to come out of the Middle East. And the reverse is also true. As things pick up, as they undoubtedly will, as economic recovery worldwide takes place, there will be increasing dependence of the world oil market on Middle Eastern supplies.

Although we are making significant strides in energy conservation and in stockpiling short-term strategic reserves of oil, we should, as a national policy, be encouraging and continuing to encourage the development of the country's vast and diverse synthetic fuels resource bases for the long term.

In today's uncertain energy markets, consistent and predictable Government policies are required to encourage companies to proceed with the development of replicable commercial synthetic fuels facilities. In this connection, it is important to recognize the changes in the Federal tax treatment of synthetic fuels in the last year have lowered the rates of return on these projects. I am referring here to the passage, last August, of the Tax Equity and Fiscal Responsibility Act of 1982, and the expiration on December 31 of this past year of the Energy Investment Tax Credit for companies unable to meet the affirmative commitment deadlines. Together, these two changes in tax law affecting synthetic fuels property have affected the rate of return—cut the rate of return on equity by as much as 30 percent.

It is important, therefore, that the Congress enact legislation this year that would maintain and strengthen the Energy Investment Tax Credit for synthetic fuels projects. Such a step would contribute to the economic strength of projects struggling to get on their feet under current conditions, and would go far, we believe, toward assuring the energy industry that the Congress is willing to take the long view in forging predictable and stable tax policy to encourage private investment in synthetic fuels projects.

We thank you, Mr. Chairman and members of the committee, for your interest in this issue and for your longtime support of synthetic fuels development. And I will be pleased to answer any questions that you may have.

[The prepared statement of Mr. Koleda follows:]

National Council
on
Synthetic Fuels Production

TESTIMONY

OF

MICHAEL S. KOLEDA
PRESIDENT
NATIONAL COUNCIL ON SYNTHETIC FUELS PRODUCTION

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

COMMITTEE ON SCIENCE AND TECHNOLOGY

U. S. HOUSE OF REPRESENTATIVES

JULY 12, 1983

1825 Eye Street, N.W. • Suite 1050 • Washington, D.C. 20006 • (202) 887-1285

Mr. Chairman, members of the Subcommittee, my name is Michael Koleda. I am President of the National Council on Synthetic Fuels Production -- the trade association of the synthetic fuels industry. Our member companies are involved in the principal synthetic fuels projects under consideration in the United States today, and we believe that America's vast deposits of oil shale and coal will become important sources of petroleum supplements and substitutes through the end of this century and into the next.

We in the synthetic fuels industry appreciate the vision and leadership that you and other members of the Science and Technology Committee have brought to public policymaking in the energy area over the past decade. We are grateful for your interest in the issue of tax incentives for new energy technologies and we are happy to have the opportunity to express our views today.

As you know, Mr. Chairman, under current law the Energy Investment Tax Credit (EITC) is only partially effective for synthetic fuels projects. One problem is that a synfuels project is eligible for the credit only if its sponsor had shown an "affirmative commitment" by completing engineering studies and permit applications by the end of 1982. Another problem is that the credit cannot be applied to some types of synthetic fuels or to some types of project equipment.

We in the synthetic fuels industry urge you and other members of the Science and Technology Committee to support current legislative efforts to make the EITC fully effective for synfuels projects. One bill -- S. 1396 -- would extend "affirmative commitment" deadlines and expand coverage of the EITC to include ancillary project equipment, shale oil preprocessing equipment and tar sands projects. Another bill -- H.R. 3283 -- would extend "affirmative commitment" deadlines and expand the definition of eligible shale oil equipment.

Passage of legislation extending and expanding the EITC would signal a consistency in federal tax policy toward long-term resource base development projects. Such consistency is of great importance if industry is to build the long lead time, large scale, technically challenging synthetic fuels projects whose justification is tied to the long-term energy requirements of the economy and to national security.

Extending and expanding the EITC also would improve the basic economics of synthetic fuels projects thereby contributing to the prospects that the private sector -- within the confines of its own decision-making framework -- can bring into commercial use the technologies to transform coal, oil shale, tar sand, heavy oil and biomass into clean-burning petroleum supplement and petroleum substitute fuels.

Synthetic fuels development offers the United States a potential new avenue of industrial success. These projects extend our energy horizons while providing productive jobs and long-term tax revenues well into the next century. Our country, its people and elected leaders possess the necessary manpower skills, natural resources and vision to make this happen.

Congressional action this year on the EITC would send a timely message to the energy industry in the United States and to our oil import dependent allies abroad that the United States has not once again been mesmerized by the apparent surpluses in the world oil markets and that we are not retreating from our national responsibilities to ensure energy availability for a growing economy in the decades ahead.

Mr. Chairman, the plain facts are that the U. S. energy resource base is heavily skewed toward solid fossil fuels -- principally coal and oil shale. Domestic oil and gas reserves are barely holding steady despite an enormous increase in drilling activity in the past couple of years. The United States will make the transition to greater reliance on clean-burning fuels from solid resources because of the reality of our reserve situation. Whether this transition is made deliberately as a matter of choice or achieved frantically as a matter of necessity is up to us. National policy to assist the development of a U. S. synthetic fuels production capability -- through the Synthetic Fuels

Corporation and through incentives in the tax code -- allows the U. S. to determine how this transition to greater reliance on solid fossil fuels is to proceed. Failure to sustain the synfuels incentives in the face of current economic and market conditions is to relinquish control of the timetable for synthetic fuels development in the U. S. to world politics and the interests of cartel-minded oil exporting nations.

However, despite this clear need to assemble and demonstrate commercial technologies that will turn these largely untapped solid energy resources into readily usable liquids and gases, synthetic fuels development in the United States has slowed dramatically in the past few years. The reasons are understandable, if lamentable.

Commercial synthetic fuels projects are large-scale efforts requiring billions of dollars of capital investment.

The projects require long lead times -- 5 to 7 years in the construction phase alone -- that delay capital recovery of the billions of investment dollars.

The projects require the construction and operation of mining, materials handling, retorting and upgrading technologies at a much larger scale than have previously been demonstrated.

And the profitability of the projects -- the basic element to attract capital in a market economy -- depends on continued increases in real oil prices through the remainder of the century.

Four years ago, Mr. Chairman, the unforeseen Iranian revolution cut world oil production by approximately 5 percent. Yet, world oil prices on the spot market doubled in a single year. Real oil prices were widely expected to increase steadily through the end of the century. In that climate, the private sector naturally focused its attention on the benefits of synthetic fuels production projects over the longer term.

At the same time, the government was developing a synthetic fuels policy to encourage nearer term production to provide for the energy requirements of the civilian and military sectors and protect the integrity of the underlying economy from price manipulation or supply embargoes by oil-exporting nations. In 1979, government and industry were each pursuing synfuels for different reasons that reflected their own responsibilities.

The current energy market is unsettled and the future is uncertain. However, we are all hoping for and have seen the early signs of a gradual economic upturn. Published articles on the future of energy prices now seem to agree that gradually tightening markets and a slow resumption of real oil price increases will accompany the economic recovery. But tightening world oil markets and the continuing political instability of the Middle East are the unfortunate "facts of life" in the world's energy supply picture. The troubled Middle East still contains nearly two-thirds of the world's proved oil reserves and produces almost one-third of the free world's oil. Although we are making significant strides in energy conservation and in stockpiling short-term strategic reserves of oil, we should as a national policy be encouraging the development of this country's vast and diverse synthetic fuels resource bases for the long-term.

In today's uncertain energy markets, consistent and predictable government policies are required to encourage companies to proceed with development of replicable, commercial synthetic fuels facilities.

In this connection it is important to recognize that changes in federal tax treatment in the last year have lowered rates of return on synthetic fuels projects. I am referring here to the passage last August of the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) and the expiration on December 31, 1982 of the Energy Investment Tax Credit for companies unable to meet the affirmative commitment deadline.

The combined impact of TEFRA and the failure to extend the EITC affirmative commitment deadlines has lowered by as much as 8 percent the anticipated rate of return on investment on synthetic fuels projects and has lowered by as much as 30 percent the rate of return on equity.

Mr. Chairman, as I have pointed out in my testimony, the market incentives to develop synthetic fuels projects have eroded sharply since 1981. The tax treatment changes of the past nine months have further reduced the rate of return on synthetic fuels projects and have eroded confidence in government's commitment to the synthetic fuels component of our long term energy strategy.

It is important, therefore, that Congress enact legislation this year that would maintain and strengthen the Energy Investment Tax Credit for synthetic fuels projects. Such a step would contribute to the economic strength of projects struggling to get on their feet and would go far toward assuring the energy industry that the Congress can take the long view in forging predictable and stable tax policy to encourage private investment in synthetic fuels projects.

Thank you, Mr. Chairman, for your interest in this issue and for your longtime support of synthetic fuels development. I will be pleased to try to answer any questions that you may have.

Mr. **Fuqua**. Thank you very much.

What projection would you make with—now it appears that interest rates are beginning to increase, particularly short-term, have still been up, and it appears that long-term interest rates may start to edge up. What impact—should that happen, that scenario, and it increases—and I don't mean that it goes back like it was 2 or 3 years ago, but not a decline, what impact do you think that will have on the development of synthetic fuels and alternative energy sources if we do see another increase in interest rates?

Mr. **Koleda**. Well, there are others here on the panel who may want to respond as well at another point to that. But I would simply say, Mr. Chairman, that any increase in real interest rates has a tendency to drive industry across the board away from long-term capital intensive projects and toward the short run.

You know, about 1980 we saw a very dramatic shift in this situation from, frankly, negative real interest rates to positive real interest rates. You read some about that in the press, but it is a big sleeper issue. The shift from negative real interest rates to positive real interest rates caused industry across the board to move to become liquid, to get out of debt and to go short-term. And so, since we are talking here in synthetic fuels about big capital sitting there for a number of years before oil starts to flow, and then for a long period of time, it would have a very serious negative impact on efforts like this for the long-term energy security of this country.

Mr. **Fuqua**. Questions from any of the other members?

Mr. Bateman.

I might point out that he has a time problem, and he needs to leave in 15 or 20 minutes. But I thought we would go ahead and ask our questions of him.

Mr. **Bateman**. Fine. Thank you, Mr. Chairman; I will try to make this a quick one.

In your statement you point out as potential alternative sources of energy not only oil shale, tar sands, heavy oil, and biomass, as alternative sources to be encouraged, but, of course, there is coal. Do you have any views as to which of those alternatives is most feasible short-range, and which, perhaps, should be encouraged more than others?

Mr. **Koleda**. That is a good question. I would say that—and again, I think that the individuals from the Synthetic Fuels Corporation would want to comment on how they see it. But generally speaking, as a broad-brush statement, if you are talking about heavy oils and tar sands, you are probably talking about projects that are in the near term, more likely to move ahead more quickly. They tend to be smaller, they tend to be perhaps a little more economic.

Generally speaking, shale would come next, among the ones that we are talking about here: The heavy oils, tar sands, shales, and coal. The gasification of coal and perhaps the direct liquefaction of coal would be at the bottom of the list in terms of that kind of a ranking at the moment.

But in the long run, against that, you have to look at the fact that shale and coal, and in many ways coal, are enormous resources. So even though they may be a little less economic, possibly, in the near term, their long-term production potential is enormous.

Mr. **Bateman**. Would you consider the fact that the coal mining industry in the country, which has been a major economic factor in several regions of the country, may present some superior case for encouragement of coal gasification or liquification, because of what it would do for an industry where unemployment is very high and the regional economies are impacted very negatively. Does that tilt the scales in favor of further or greater encouragement for coal liquification or gasification?

Mr. **Koleda**. I think it is a factor, Mr. Bateman, that has to be taken into account. There were a number of questions of the previous witness about the revenue losses associated with the energy investment tax credit. And, of course, the counter to that is that these tax credits, to the extent that they are used, they stimulate investment; that investment leads to tax revenues. And most of the projections that we have seen, even if you discount the flow of those revenues, shows a very positive factor, a multiple of 6 or 10 or whatever.

Now, the Congress has to be concerned about a wide range of issues, and one of them certainly is unemployment. We have the resources, we have the coal, we have the energy base. We need the liquid fuels and we need the liquid replacing fuels, particularly if you take a long-term horizon, as the Congress must do.

So that is a very strong additional argument.

I would also go on to say that increasingly in the coal industry the future—many of us believe—lies with these new technologies that can create clean fuels out of fuels that are increasingly being seen as having problems. This is going to be of great importance to the northeast.

We are going to have to rely on coal. We are going to rely on it very quickly and very heavily if we run into a third energy situation which could arise any time with the politics in the Middle East. If we do it under a crash effort, we are going to be going with whatever coal we have got, and burning it the cheapest and easiest way possible. If we can develop now the technologies that will allow us to use that coal cleanly, I think we will have done a very great service for the country, not only from an energy supply point of view, but from an environmental point of view, looking down the road. If, in the process, we can alleviate the terrible unemployment that exists in the coal belts of this country, I think we have got a 3 for 1 that is pretty hard to beat.

Mr. **Bateman**. Mr. Chairman, just as a brief aside, in light of the testimony that the tax incentives really produced revenue, it occurred to me that maybe we ought to double the incentives, and that way we would double the revenue. [General laughter.]

Thank you, Mr. Chairman.

Mr. **Fuqua**. Very good point.

Mr. Lewis?

Mr. **Lewis**. I have no questions, Mr. Chairman.

Mr. **Fuqua**. Thank you.

Mrs. Schneider?

Mrs. **Schneider**. No questions.

Mr. **Fuqua**. Thank you.

Thank you very much, Mr. Koleda.

Mr. KOLEDA. Thank you, Mr. Chairman.

Mr. FUQUA. Any time you need to excuse yourself, please feel free to do so.

Mr. KOLEDA. I appreciate it.

Mr. FUQUA. Mr. Miller?

Mr. MILLER. Thank you, Mr. Chairman.

The Synthetic Fuels Corporation is pleased to offer its views on energy tax incentives, particularly the energy investment tax credit, or ETC.

My comments will apply only to tax incentives that affect projects that the SFC is authorized to support, which are plants to produce synthetic fuels primarily from solid resources, coal, oil shale, and tar sands. As it is unlikely under current economic conditions that the private sector will build synfuel plants without assistance, our calculations may be taken to represent the entire industry.

A few years ago Congress provided two kinds of incentives for synthetic fuels. First came the ETC in 1978 and then the production tax credit as part of the Windfall Profit Tax Act of April, 1980. The second incentive was direct loan and price support assistance, to be provided by the SFC, which was authorized by the Energy Security Act on June 30, 1980.

Now, it is clear that Congress intended to offer the fledgling synfuels industry the dual incentives. The two forms work well together. The ETC, along with the regular investment tax credit, helps the synfuel sponsor by providing an upfront cash flow that encourages capital formation. In contrast, both the production tax credit and SFC's assistance are for longer terms. Our price guarantees underwrite up to 10 years of operations while our loan guarantees may extend for 10 to 25 years. The operative assumption here is that after the price support period, the project will be competitive over the rest of its roughly 30-year life.

While Congress correctly perceived the need of a combination of stimuli, it did not accurately gage the difficulties that would be encountered in mobilizing capital for the new industry. The fundamental problems have been the weak economic environment prevailing since about 1980 and reduced optimism about the price of energy. Two years ago the median of published forecasts for crude oil was $60 per barrel in 1990 and $80 for 2000. All figures here are expressed in constant 1983 dollars. Such projections are now at about $35 for 1990 and $52 at the end of the century, and most synfuel sponsors are predicting even lower levels, typically about $35 at the end of the century.

These projections and the weak cash flows of many companies, are causing corporate sponsors to reassess their plans, and some have withdrawn their projects. Development of synfuels was further discouraged by the TEFRA Act in 1982, which reduced capital formation benefits such as expensing of interest during construction and reduction of depreciable basis by 50 percent of the ITC and ETC taken.

The ETC improves the return to an investor in a synfuels plant by increasing his leverage. The SFC can guarantee loans for up to 75 percent of the cost of a project, but the remaining 25 percent must be provided as private-sector equity. This 25 percent is a large amount; in a $2 billion project, the equity need is $500 million. The ETC, by providing an immediate cash benefit to sponsors, greatly assists in capital formation and makes the funding of projects more viable.

Although the SFC is authorized to make awards through 1992 and the production tax credit will be available through the end of the century, Congress put a fairly short time fuse on the ETC for solid fuels. It is true that expenditures through 1990 may qualify for the credit, but only when a sponsor completed by the end of 1982 his engineering studies and permitting requirements. In addition, the synfuel sponsor must have contracts for half of his specially designed equipment by the end of 1985.

These two affirmative commitment dates are proving to be unrealistic. Because of the energy market downturn, not many sponsors were willing to spend the large sums needed to advance synfuel projects on a fast track. Relatively few have been able to organize their syndicates and get their permits. Of the 15 coal and oil shale projects now pending before SFC, we estimate that only about 6 met last year's deadline and are thus grandfathered for the ETC. Allowing for new projects we expect to appear later, the grandfathered projects will probably account for about 40 percent of our total assistance awards.

As you know, Senator Domenici and others recently introduced bill S. 1396, and subsequently Representative Ed Jenkins of Georgia offered H.R. 3283. The Domenici bill enhances the effectiveness of the ETC in three important ways. First, it solves the deadline problem for the other 60 percent of our projects by extending the 1982 affirmative commitment date by 4½ half years, and by providing additional time and flexibility for the second date. This problem is also addressed by H.R. 3283. Second, S. 1396 includes tar sands outlays as eligible expenditures. Although the U.S. tar sands resource is smaller than either coal or shale, we are finding that tar sands projects are more numerous and can be in operation more quickly than other types and at a lower cost per barrel of assistance.

Finally, the Domenici bill allows investors in coal and shale projects the full ETC on so-called off-stream facilities, like oxygen plants, which are now excluded from qualified expenditures. The ETC today is the equivalent of only about a 6 percent investment tax credit because of the exclusions. Allowing the credit on off-stream items would raise the ETC to a more effective 9 to 10 percent.

We are sometimes asked if the limitation of the ETC is causing the cancellation of synfuels projects. The answer is "no," not directly. But in a broader sense, limiting the credit does hinder private sector development of synfuels. In our negotiations we bargain toward price supports set to yield a rate of return that appears to be appropriate to the risk involved. If the project isn't eligible for the ETC, it necessarily requires a greater amount of support.

We have calculated the trade-off between the ETC and the amount of aid that the SFC must give in its absence. We estimate the multiplier at about 3.7 to 1; that is, it takes almost $4 of additional SFC aid to compensate for $1 of lost ETC. Let me explain.

A dollar of ETC is a net, bottom line benefit to the sponsor, realized in the first years of a project. In contrast, a dollar of loan guaranteed by SFC has to be repaid in the future, with interest, and thus has a lower net present value. As for price supports, they will be paid out over a period of future years and will be taxed as ordinary income, so their net present value is also low. At the margin our additional assistance will be a combination of both forms.

The Senate bill, which might create an additional $1.1 billion of ETC's for synfuels, is the equivalent of adding $4 billion to SFC's present obligational authority, which is about $15 billion. This would permit us to increase the number of major projects financed from, say, 10 to 13 As there are about 20 important resource/technology combinations other than tar sands, the bill would permit us to substantially broaden the portfolio of pioneering commercial projects that will improve the base for industry expansion.

It is interesting that the negative impact of TEFRA, calculated in the same way, is equivalent to about $4.7 billion of our assistance. In other words, the proposed ETC improvement bill would not quite offset TEFRA's crimping of our ability to finance a greater number of projects.

Let me comment on revenue loss and gain from S. 1396 as we see it. The initial revenue loss, over the next 5 or 6 years, assuming SFC is successful in its mission, may be about $1.1 billion. It is possible that some or all of this may be recouped by the Treasury in the late 1980's and early 1990's as an offset to the production tax credit if oil prices remain low in real terms.

More importantly, assuming the bill permits us to finance three additional plants, and that such plants are like those now before us, the Treasury may expect to collect about $13 billion in income taxes over their lives. These figures are based on our long-range price forecasts. There will be additional large revenues generated by taxes on wages, suppliers' profits, and so forth. As synfuels plants will back out imported energy rather than domestic production, these may be considered net gains to the Treasury.

Turning for a moment to the production tax credit, the fall in energy prices has enhanced its value to synfuel sponsors. At today's oil and gas prices, the credit is fully operative. By around 1990, when significant synfuel production may be expected to begin, the credit might be around $5 to $6 per barrel if prices have not risen. As the production tax credit is a bottom line benefit, it would then be equivalent to a price increase of around $10 per barrel, indeed, a powerful stimulus to production.

In closing, it has become clear that the Nation needs to employ its entire arsenal of incentives if we are to launch a synthetic fuels industry in this decade. As envisioned by Congress several years ago, the Tax Code and the SFC were to provide a balanced set of incentives. S. 1396 or, as a bare minimum, H.R. 3283, would restore the balance and allow synthetic fuels development to go forward in a responsible, market-oriented manner.

Thank you for giving me the opportunity to address this important subject.

[The prepared statement of Mr. Miller follows:]

TESTIMONY BEFORE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE'S SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

by Edward S. Miller
Vice President for Finance
United States Synthetic Fuels Corporation
July 12, 1983

The Synthetic Fuels Corporation is pleased to offer its views on energy tax incentives, particularly the energy investment tax credit (ETC). My comments will apply only to tax incentives that affect projects the SFC is authorized to support, namely plants to produce synthetic fuels primarily from solid resources--coal, oil shale and tar sands. As it is unlikely under current economic conditions that the private sector will build synfuels plants without assistance, our calculations may be taken to represent the entire industry.

A few years ago Congress provided two kinds of incentives for synthetic fuels. First came the ETC, in 1978, and then the production tax credit as part of the Windfall Profit Tax Act of April 1980. The second incentive was direct loan and price support assistance, to be provided by the SFC, which was authorized by the Energy Security Act on June 30, 1980.

It is clear that Congress intended to offer the fledgling synfuels industry the dual incentives. The two forms work together quite well. The ETC (along with the regular investment tax credit) helps the synfuel sponsor by providing an up-front cash flow that encourages capital formation. In contrast, both the production tax credit and SFC's assistance are for longer terms--our price guarantees underwrite up to 10 years of operations while our loan guarantees may extend for 10 to 25 years. The operative assumption is that after the price support period, the project will be competitive over the rest of its roughly 30 year life.

While Congress correctly perceived the need of a combination of stimuli, it did not accurately gauge the difficulties that would be encountered in mobilizing capital for the new industry. The fundamental problems have been the weak economic environment prevailing since about 1980 and reduced optimism about the price of energy. Two years ago the median of published forecasts for crude oil was $60 per barrel in 1990 and $80 for 2000, both expressed in constant 1983 dollars. Such projections are now at about $35 and $52 respectively. Most synfuel sponsors are predicting even lower levels, typically about $35 at the end of the century. These projections, and the weak cash flows of many companies, are causing corporate sponsors to reassess their plans, and some have withdrawn their projects. The development of synfuels was further discouraged by TEFRA in 1982, which reduced capital formation benefits such as expensing of interest during construction and reduction of depreciable basis by 50% of ITC and ETC taken.

The ETC improves the return to an investor in a synfuels plant by increasing his leverage. The SFC can guarantee loans for up to 75% of the cost of a project but the remaining 25% must be provided as private sector equity capital. This 25% is a large amount; in a $2 billion project, the equity need is $500 million. The ETC, by providing an immediate cash benefit to sponsors, greatly assists in capital formation and makes the funding of projects more viable.

Although the SFC is authorized to make awards through 1992 and the production tax credit will be available through the end of the century, Congress put a fairly short time fuse on the ETC for solid fuels. It is true that expenditures through 1990 may qualify for the credit, but only when a sponsor completed by the end of 1982 his engineering studies and permitting requirements. In addition, the synfuel sponsor must have contracts for half of his specially designed equipment by the end of 1985.

These two "affirmative commitment" dates are proving to be unrealistic. Because of the energy market downturn, not many sponsors were willing to spend the large sums needed to advance synfuels projects on a fast track. Relatively few have been able to organize their syndicates and get their permits. Of the 15 coal and oil shale projects now pending before the SFC, we estimate that only about 6 met last year's deadline and are "grandfathered" for the ETC. Allowing for new projects we expect to appear later, the grandfathered projects will probably account for about 40% of our total assistance awards.

As you know, recently Senator Domenici and others introduced S. 1396. Subsequently, Rep. Ed Jenkins (D-Ga.) offered H.R. 3283. The Domenici bill enhances the effectiveness of the ETC in three important ways. First, it solves the deadline problem for the other 60% of our projects by extending the 1982 affirmative commitment date by 4-1/2 years and providing additional time and flexibility for the second date. This problem is also addressed by H.R. 3283. Secondly, S. 1396 includes tar sands outlays as eligible expenditures. Although the U.S. tar sands resource is smaller than either coal or oil shale, we are finding that tar sands projects are more numerous and can be in operation more quickly than other types, and at a lower cost-per-barrel of assistance.

Finally, the Domenici bill allows investors in coal and shale projects the full ETC on so-called off-stream facilities, like oxygen plants, which are now excluded from qualified expenditures. The ETC today is the equivalent of about a 6% investment tax credit because of the exclusions. Allowing the credit on off-stream items would raise the ETC to a more effective 9% to 10%.

We are sometimes asked if the limitation of the ETC is causing the cancellation of any projects. The answer is "no," not directly, but in a broader sense limiting the credit does hinder private sector development of synfuels. In negotiations we bargain toward price supports set to yield a rate of return that appears to be appropriate to the risk involved. If the project isn't eligible for the ETC, it necessarily requires a greater amount of support.

We have calculated the tradeoff between the ETC and the amount of aid the SFC must give in its absence. We estimate the multiplier at about 3.7 to 1; that is, it takes almost $4 of additional SFC aid to compensate for $1 of lost ETC. Let me explain. A dollar of ETC is a net bottom-line benefit to the sponsor realized in the first years of a project. In contrast, a dollar of loan guaranteed by SFC has to be repaid in the future, with interest, and thus has a lower net present value. As for price supports, they will be paid over a period of future years and will be taxed as ordinary income, so their net present value is also low. At the margin our additional assistance will be a combination of both forms. The Senate bill, which might create an additional $1.1 billion of ETCs for synfuels, is the equivalent of adding $4 billion to SFC's present obligational authority of about $15 billion. This would permit us to increase the number of major projects financed from 10 to 13. As there about 20 important resource/technology combinations, excluding tar sands, the bill would permit us to substantially broaden the portfolio of pioneering commercial projects that will improve the base for further industry expansion.

It is interesting that the negative impact of TEFRA, calculated in the same way, is equivalent to about $4.7 billion of our assistance. In other words, the proposed ETC improvement bill would not quite offset TEFRA's crimping of our ability to finance a greater number of projects.

Let me comment on revenue loss and gain from S. 1396, as we see it. The initial revenue loss, over the next 5 or 6 years, assuming SFC is successful in its mission, may be about $1.1 billion. It is possible that some or all of this may be "recouped" by the Treasury in the late eighties and early nineties as an offset to the production tax credit, if oil prices remain low in real terms. More importantly, assuming the bill permits us to finance three additional plants and that such plants are like those now before us, the Treasury may expect to collect about $13 billion in income taxes over their lives. These figures are based on our long range price forecasts. There will be additional large revenues generated by taxes on wages, suppliers' profits, and so forth. As synfuel plants will back out imported energy rather than domestic production, these may be considered net gains to the Treasury.

Turning briefly to the production tax credit, the fall in energy prices has enhanced its value to synfuel sponsors; at today's oil and gas prices, the credit is fully operative. By around 1990, when significant synfuel production may be expected to begin, the credit might be around $5 or $6 per barrel if prices have not risen. As the PTC is a bottom line benefit, it would then be equivalent to a price increase of around $10 per barrel, indeed a powerful stimulus to production.

In closing, it has become clear that the nation needs to employ its entire arsenal of incentives if we are to launch a synthetic fuels industry in this decade. As envisioned by Congress several years ago, the tax code and the SFC were to provide a balanced set of incentives. S. 1396 or, as a bare minimum, H.R. 3283 would restore the balance and allow synthetic fuels development to go forward in a responsible, market-oriented manner.

Thank you for giving me the opportunity to address this important subject.

Mr. FUQUA. Thank you very much, Mr. Miller.

Dr. Weiss?

Dr. WEISS. Thank you, Mr. Chairman.

My name is Joel Weiss, and I am chairman of the Government Relations Committee of the Solar Energy Industries Association. I am also the manager of Washington operations for the Acurex Corp., a California-based solar energy firm marketing nationwide.

I have a prepared statement for the record, and I will simply summarize it this morning.

Mr. FUQUA. We will make your prepared statement, in its entirety, part of the record. And if you wish to summarize it, please do.

Dr. WEISS. Thank you.

Mr. Chairman, members of the subcommittee, this committee has been involved and associated with solar energy programs for quite some time now, and I think in looking at what we have done over the past 10 years, it is now quite apparent that it was extremely optimistic to expect that technologies that were heavily in the R&D phase in the late 1970's and early 1980's—it was optimistic to expect that they could successfully be commercialized with tax credits which expire in 1985.

Although this optimistic assumption might once have been achievable, three key events in the past several years have made this goal of full commercialization by 1985 virtually unattainable.

Mr. Miller and Mr. Koleda have talked of two of these events. Of course, the two principal ones are the so-called oil glut, which has been accompanied by falling fossil fuel prices. The second was the passage of the Tax Equity and Fiscal Responsibility Act of 1982, the basis adjustment of which substantially eroded the value of existing tax credits.

And as for renewables, there is a third one, and that is the severe reductions in Federal R&D expenditures for solar energy which have delayed development schedules for many technologies.

For these reasons, it is now fairly clear that by the end of 1985 when the renewable energy credits expire, the solar energy industry will not be sufficiently self-sustaining to permit it to aggressively market its products and continue the commercialization of these technologies at the pace which all of us desire.

So that brings us, therefore today, to a discussion of extension and expansion of the solar energy credits.

Now, several questions were asked of Senator Matsunaga about the cost of energy tax credits. I would like to touch upon that item a little bit and answer it in a slightly different manner than any of the preceding witnesses.

An analysis of energy tax credits that was recently completed by Booz-Allen & Hamilton for the Solar Energy Industries Association, states that with increased tax credits, renewable energy could displace over 30 million barrels of oil annually by 1990. That is about a fifth of a quad. That is also about a $10 billion industry, about a factor of 20 from where we are today.

Now, one key fact that Booz-Allen brought out in their report—and I will quote—"the benefits derived from the credits would be obtained at minimal present value cost to the Government." The cost of the tax credits would be partially offset by fewer tax deductions taken for conventional fuel expenses by commercial users of renewable energy systems. For business energy tax credits, in fact, the study estimates that a net revenue gain of more than $600 million in 1990 could result from renewable energy tax credits.

Now, let me differentiate this type of positive cash flow from what the other speakers have been talking about.

What we are saying here is that if a solar energy system is sold, and if it works—and we have every reason to believe it will—then it will displace conventional fuel that would have otherwise been expensed. That fuel would have had a Treasury cost through the expensing provisions of the Tax Code. On a net present value basis, using a 7-percent discount rate as prescribed by OMB as the Government opportunity cost, the result of a tax credit taken in 1990 on a solar energy system with a life span of 20 years, under very conservative fuel escalation assumptions, would be to have a net positive cash flow to the Treasury of several hundreds of millions of dollars.

Now, I would like to make that point, that this is solely because of the fact that a solar energy system comes up front with all that fuel that otherwise would have had to have been expensed.

Now, turning for a moment to what the Solar Energy Industries Association position is on extension of tax credits, let me point out that the companies in this association are not desirous of asking for tax credits indefinitely. But we do feel that there are sound economic arguments to request some modification and extension through the year 1990. Accordingly, SEIA recommends that, first, the Congress extend the residential solar energy tax credit through 1990 at its present 40 percent value; second, that Congress increase the business energy tax credit to 25 percent and extend it through 1990; third, that Congress redefine the 10-percent investment tax credit so that it will be applicable to all applications of solar energy in buildings; and, fourth, that Congress add an affirmative commitment period for the tax credits through 1995.

As has been noted before, earlier this morning, several bills have been introduced. Of course, the chairman and Mr. Lujan have cosponsored H.R. 1775, which contains the requested increase to 25 percent and the extension through 1990. Mr. Heftel has introduced H.R. 3072, which has been cosponsored by a number of members of this committee, including the chairman. It is a slightly more comprehensive bill, and covers all of the points in SEIA's recommendation.

Mr. Chairman, we thank you for your continued support—yourself and this committee—for solar energy. And I thank you for your time this morning.

[The prepared statement of Dr. Weiss follows:]

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U. S. HOUSE OF REPRESENTATIVES
SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS

STATEMENT ON BEHALF OF
SOLAR ENERGY INDUSTRIES ASSOCIATION
ON
RENEWABLE ENERGY TAX CREDITS

PRESENTED BY
JOEL A. WEISS, CHAIRMAN, GOV'T. RELATIONS COMM.
SOLAR ENERGY INDUSTRIES ASSOCIATION

July 12, 1983

Mr. Chairman and Members of the Subcommittee:

My name is Joel Weiss and I am the Chairman of the Government Relations Committee of the Solar Energy Industries Association (SEIA). I am also the Manager of Washington Operations for the Acurex Corporation, a California-based solar energy firm marketing nationwide. I appreciate this opportunity to testify both personally and on behalf of the Solar Energy Industries Association, a national trade association for solar businesses comprising over 500 companies.

Before addressing the issue of the effect of business energy tax credits and residential tax credits on the solar industry, and comments on other aspects of the current national solar business, I would like to provde a brief summary of facts regarding the status of various solar technologies which are being utilized by SEIA-member companies.

Active Solar Heating & Cooling

Approximately 250 collector manufacturer form the core of the solar heating and cooling industry, and are a barometer of industry performance. Material and component suppliers upstream, and the distribution and installation businesses downstream form the whole industry. Ultimately, system suppliers will be regarded as the core of the industry. The companies vary in size from divisions of Fortune 500 firms to small privately held firms, some with significant market shares. The majority however, are small, with 80 percent of collector companies reporting fewer than fifteen employees. The industry is still in its infancy with high

high turnover due to low rates of return, acquisitions or failures, and the relatively low cost of entry.

The industry is highly concentrated. In 1982, 13 percent (8 companies) shipped 83 percent of low-temperature collectors (typically unglazed plastic), and fourteen percent (34 compaines) shipped 74 percent of medium temperature collectors. In 1981, medium temperature collector production exceeded low temperature production for the first time, and now dominates the industry in dollar value. Leading firms produce $10-25 million in hardware per year.

Gross sales in 1981 totaled over $600 million for active solar collectors. In 1981, 42 percent of production came from California companies, and 24 percent from Florida companies. California, Arizona, and Florida provided the largest markets.

Cumulative installation of active collectors through 1982 was approximately 550,000 systems. Installations in 1981 reveal the following applications:

1981 Installations

102,000	Single Family water heaters
25,000	Swimming pool heaters
18,600	Single family space heaters
6,400	Other
152,000	Total Installations

Estimates of energy produced by active systems installed since 1980 equals about 0.01 quads per year. Exports and imports of active solar hardware are insignificant.

PHOTOVOLTAICS

Dramatic efficiency improvements and cost reductions have been achieved in photovoltaic technology in the last decade. Six basic photovoltaic technologies can now be identified: Single crystal silicon; semi or polycrystal; silicon ribbon; amorphous silicon; optical concentrator and advanced thin films.

In the last five to seven years:

- o Single crystal silicon modules have dropped from $100/per peak watt (wp) to approximately $5/wp
- o Single crystal cell efficiencies rose from 7% to 15%
- o Amorphous silicon cell efficiency rose from 1% to 10% (laboratory)
- o Ribbon and polycrystalline cell technology now being introduced
- o Concentrator cells achieved over 20% efficiency in laboratory
- o Multilayered cells promise 30+% efficiency

According to DOE, nineteen U.S. manufacturers shipped modules in 1982. Major corporations still have a vital role in innovation and in commercialization of the technology. Private industry investment in PV from 1972 to 1982 was about $350 million (federal funding same period, $628 million).

Two years ago, U.S. firms accounted for 70% of world-wide sales. Their portion has slipped to 50%. The industry is characterized by constant movement forward. Because total turnover is less than $150 million for hardware and R & D expenditure is so high, the industry may still be characterized as fragile, but extremely promising.

The current market is dominated by flat plate crystalline silicon technology (60+% share). U.S. sales growth has been strong:

1979	1980	1981	1982
1.4MW	3.2MW	4.5MW	6.9MW

The 1982 world market was 9-12 MWp.

U.S. production in 1982, as cited by DOE:

Sectors	MWp	%
Residential	0.827	12
Commercial	3.48	50
Industrial	1.64	24
Agriculture	0.219	3
Other	.719	10

Stand alone systems and utility-grid connected independent power production projects each account for about 45% of the market. Cost per watt for modules ranges between $5.00-$10.00/wp and the industry is delivering systems overseas producing power from $.40 to $.70 kwh.

Two surprising trends:

Residential sector growth has been higher than expected

Large-scale systems built exclusively to sell power to utilities are being encouraged by various incentives and regulations.

For photovoltaics to compete unsubsidized with grid-produced power, a 10 fold cost reduction will be required.

SOLAR THERMAL

The solar thermal industry consists of about 50 companies involved in the several technologies. They range from small high technology firms to large aerospace and petroleum companies. Industry has been largely dependent on federal funding for R & D.

Three main segments of the industry, troughs, dishes, and central receivers, are in different commercial development stages. Two main trough suppliers remain in business and appear on the verge of commercial success.

The parabolic trough industry has passed through the stage where the government was its main customer (over 2 million ft^2 installed) to a small level of commercial sales ($2-4 million per year). The industry is just on the verge of selling privately funded industrial process heat systems, but the market appears limited to only 5 to 10 such projects a year. The depreciation basis adjustment provision in the 1982 tax bill (TEFRA) and declining oil prices have hindered commercialization.

The parabolic dish industry (devoted to electric or total energy systems) is the least advanced commercially, and highly dependent on continued government R & D. Neither solar pond or parabolic dish technology has entered the market in any commercial sense.

The central receiver companies face complicated problems regarding commercialization. Large government support stopped before a commercial scale plant was built and the risk and cost of financing a large scale central receiver plant appears too high for the private sector to handle without federal aid. The scale of the technology and vital interest of several utility companies has led to several important commercial-scale plant (operating at Barstow) initiatives, but the difficult leap from 10MW pilot plant to a commercial scale plant remains.

PASSIVE SOLAR

Passive solar heating techniques, and space cooling techniques, are well defined. Yet only a very small percentage (estimates range from less than 1 percent to about 5 percent) of new housing is built with passive solar design. Of that percentage, many are probably "suntempered", since many builders find this to be a simple cost-effective approach.

Since buildings use over a third of the total energy consumed in this country, the potential for energy savings in this sector is great. The potential stimulus to the building industry, if passive solar were to become popular, is also large, since passive solar in general uses traditional building materials and techniques. This accounts for a growing movement in the industry to promote and develop passive solar.

The barriers to more widespread use of passive solar are not really technical, since the technology is well-proven. The barriers tend to be informational: builders do not yet know exactly how to incorporate the technology, how much it will cost, what the benefits will be, etc. Since the average homebuyer is also likely to have little knowledge about the advantages of passive solar, builders do not yet perceive a strong enough market for passive solar in most areas.

ORIGIN OF TAX CREDITS

Moving the solar industry from research and development of products to actual marketing has taken much time and effort. In order to understand the rationale of SEIA's feeling that the Congress should extend solar tax credits, it would be useful to focus briefly on the history and origin of this legislation.

In reaction to the oil supply disruption of the early 70's the Congress recognized the nation's need for alternative energy sources and established a federal solar energy program. In 1978 the first renewable energy tax credits were established as part of the National Energy Act. These credits were expanded and extended in 1980 with the passage of the Windfall Profits Tax Act.

A stated purpose of the credits, it should be noted, was to offset inequities in the tax code which favor fuel consuming technologies relative to those which are fuel free. These inequities, which result from the expensing of conventional fuel in the year of use, are among the most significant factors inhibiting the commercialization of renewable energy in a time of high interest rates and constrained investment capital. This was recognized in 1980 when an effort was made to increase the Business Energy Investment Credit for renewable energy to 30 percent. Unfortunately this proposed increase was changed just before final passage to 15 percent as was the expiration date which was advanced from 1990 to 1985.

It is now apparent that it was extremely optimistic to expect that technologies which were heavily in the R & D phase in the late 70's and early 80's could successfully be commercialized with tax credits which expire in 1985. Although this optimistic assumption might once have been achievable, three key events in the past several years have made this goal of full commercialization by 1985 virtually unobtainable. These events were:

1. The so-called 'oil glut' which has been accompanied by falling fossil fuel prices.

2. The severe reductions in federal R & D expenditures for solar energy, which have delayed development schedules for many technologies.

3. Passage of the Tax Equity and Fiscal Responsibility Act of 1982, the Basis Adjustment provision of which substantially eroded the value of existing tax credits.

For these reasons it is now fairly clear that by the end of 1985 when the renewable energy credits expire, the solar energy industry will not be sufficiently self-sustaining to permit it to aggressively market its products and continue the commercialization of these technologies at the pace which all of us desire.

At this point some people may question whether commercialization of renewable energy technologies is attainable at all; they might even go so far as to think that failure to achieve commercialization by 1985 means that the Federal solar energy program has been a failure.

NOTHING COULD BE FURTHER FROM THE TRUTH

Those of us in the industry are confident that the performance of our products and their costs meet or even exceed the ambitious goals of the federal solar program in the 70's. We believe we have made great progress in commercializing technologies which are technologically still in their infancy; progress which is virtually unprecedented when compared with the development and commercialization time schedules of almost any other 20th century products.

No, the record of the solar program is not one of failure; it is one of almost unparalleled success. But success does not mean that the job is over either.

What we have established now is an infant industry, and even more importantly an infant marketing and commercialization process. The products are now largely developed but the hardest part is still underway. Today a businessman is not shocked to hear one of us say that we propose to produce energy for his factory from the sun. He no longer looks at us as if we had stepped out of a flying saucer. However, despite, his not being shocked he is still surprised, perplexed and somewhat uncomfortable with this new form of energy. The commercialization process is a slow one; at this stage of the process it is fragile, and highly perishable. Events like the downturn of oil prices can cause major traumas in business plans for young companies operating very close to the margin.

THE NEED FOR MORE EFFECTIVE BUSINESS ENERGY TAX CREDITS

The intent of the Congress in enacting residential and business energy tax credits for renewable energy has been partially realized through the stimulus given to the solar industry. Immediately following the enactment of the original tax credits in 1978, solar products began moving in the marketplace. Again, in 1980, following the amendments to the solar tax credits, business picked up. But despite the fact that the 40% residential tax credit has proved an adequate incentive, the 15% level for industrial, commercial and agricultural installations has not provided sufficient incentive.

To understand the marketing of solar products in the industrial, commercial and agricultural markets, let's look at what happens in a typical situation. First, one must realize the ability of businesses to expense the burning of fossil fuels which is, in effect, a 46% tax credit. For a corporate operating officer to recommend to his/her Board of Directors that a major investment be made in energy conservation and generation equipment such as solar, that officer must be able to justify that initial investment within the internal rate of return boundaries for that corporation.

When that corporation can continue to operate as it does today, expensing an item at 46% tax savings, an incredibly high rate of return would have to be shown to justify an investment such as solar energy equipment.

The 15% business energy tax credit, and the 10% investment tax credit (ITC) when it is applicable, do not come close to the 46% expensing level. For solar to be truly effective as an energy choice, parity in price must exist at the business level. Thus, a 25% business energy tax credit for solar, coupled with the ITC that applies to all business applications of solar, would allow the operating officers to sell a solar capital improvement project to his/her Board of Directors on the basis of future energy savings coupled with a comparable rate of return on that investment as compared to the present expensing level of fossil fuels.

MAKING THE 10% INVESTMENT TAX CREDIT MORE EFFECTIVE

Before discussing the need to extend the solar tax credits beyond 1985, I would like to remind the Committee about a problem we have with current IRS rules which do not allow the 10% Investment Tax Credit to apply to solar equipment for heating and cooling commercial buildings, or for providing normal service hot water. Thus, solar systems for commercial buildings can only benefit from a 15% credit. The solar industry would like to see improvement in the effectiveness of present tax credits for solar through clarification of the applicability of the 10% ITC to include all solar installations. This does no injury to the original intent of the Investment Tax Credit legislation, since its real purpose is served in providing incentives for new capital equipment. At the same time, it enhances the present 15% business energy tax credit by creating a more equitable treatment of solar energy equipment.

While the solar tax credits have been the most important incentive in the marketing of solar equipment, up to now most installations have taken place in the residential market. The business market for solar, which includes commercial, industrial, and agricultural installations, has been only partially tapped.

This fact stands in sharp contrast with the reality that the largest savings in conservation and fuel costs could be realized in the business sector, the area of greatest energy use. The growing costs of energy are reflected in price increases in every product or service dispensed in the market.

As explained previously, the traditional expensing of fossil fuels in the business community has been a barrier for solar marketing. The 15% business energy tax credit assists in closing the comparative gap, but it is only a first step. The inclusion of the 10% ITC helps, but has only limited solar business application. Certainly, the broadening of application for the ITC so that it could be combined in each instance with the business energy tax credit, would help eliminate the economic disparity with fossil fuels.

THE INSTABILITY OF GOVERNMENT POLICIES

The volatility of government programs in recent years--both regulatory policies and support programs--has had a dramatic effect on the industry. The burst of government programs in the 1970's to help commercialize renewable energy generally encouraged private investment in the field, but even during that supportive period, frequent shifts in program orientation sent confusing signals to the industry. More recent history has been characterized by dismantlement of support programs, and by repeated attacks on tax incentives and the reduction in tax incentives resulting from TEFRA. The effect has been a severe chilling of financial backing for private development of the technologies.

Uncertainty in the regulatory arena has also had a strong negative impact. Court challenges to PURPA have held in limbo the implementation of renewable energy small power production incentives in many states. The Supreme Court has now cleared much of the uncertainty surrounding PURPA with regard to Federal responsibilities and authorities. It remains to be seen whether state-by-state uncertainties will continue to be a major factor in the law's implementations.

Secretary of Energy, Donald Hodel, wrote to the Secretary of the Treasury, Donald Regan, on March 21, 1983, warning of the result of unstable tax policies for renewable energy. His letter, in part, said:

> "The developing renewable energy industry, as with other energy industries, will be unlikely to develop and mature without supportive and stable tax policies. Regulations which would reduce the rate of return on these new ventures would have an adverse impact on continued expansion and further technology development in these industries."

SEIA'S RECOMMENDATIONS AMONG VARIOUS PROPOSALS

The Solar Energy Industries Association has given considerable thought and attention to the correct position for it to recommend to the Congress regarding the future of the tax credits. The companies in this association are not desirous of asking for the tax credits indefinately, but feel that there are sound economic arguments to request some modification and extension through the year, 1990.

Accordingly, SEIA recommends that:

1. The Congress extend the residential solar tax credit through 1990 at its present 40% level.
2. The Congress increase the business energy tax credit to 25% and extend it through 1990.
3. The Congress redefine the 10% investment tax credit so that it will be applicable to all applications of solar energy in buildings.
4. The Congress add an affirmative commitment period to the legislation through 1995.

Several bills before the Congress contain all or part of the above recommendations. Congressman Wirth and Congressman Conte and others have co-sponsored H.R. 1595, which contains the increase to 25% and extension through 1990. All of these provisions are acceptable to SEIA in these bills.

above recommendations. The Chairman and Mr. Luan and others have co-sponsored H.R. 1775, which contains the increase to 25% and extension through 1990. These provisions are also contained in H.R. 1595 co-sponsored by Mr. Wirth, Mr. Conte and others.

Congressman Heftel has introduced H.R. 3072, which has been cosponsored by a number of memebers including the Chairman, which is a more comprehensive bill encompassing all our recommendations its enactment. The bill also addresses many similar tax credit needs for other renewable energy technologies. The bill now has over 40 co-sponsors and appears to be gaining more support.

Senator Bob Packwood has introduced S. 1305 which contains similar provisions to H.R. 3072 and all of the SEIA recommendations. This bill has 20 co-sponsors and appears to be gaining support also.

WHY A DECISION IS NEEDED NOW ON TAX CREDIT EXTENSION

Business planning cycles require considerable time with as much reliable and stable information as possible. While it may appear that the discussion of the extension of the renewable tax credits may be premature, since they continue through 1985, it is clear that because of the advance planning time needed, this matter should be decided this year by the Congress.

The case for extending the solar tax credits may best be illustrated by reviewing the status of the solar thermal industry developing point focus central receiver technology. This technology is ideal for the new economic environment facing U.S. electric utilities. The plants should be economically viable in the range of 100 megawatts capacity. The construction time for such plants is much shorter than for conventional energy plants, and special provisions for them shorten the regulatory process. These plants lend themselves to financing by third party venture capitalists, and utilities will be able to add capacity in the future without investing their own funds.

The financial community and the solar industry will only be able to take advantage of this opportunity if the current tax credits are extended through the transition period from technology development to commercialization. Because the federal government has seriously cut the solar research and development budget, this transition period is being lengthened. Industrial firms can be expected to take major investment risks in such new technologies only if the government shares that risk in the early introductory phases.

Given present planning horizons for the utility industry, plans developing right now could not be implemented until 1986-1987, and it would be too late the for present credits to apply. An urgent need exists to extend the tax credit through 1990 so that the first generation of commercial solar central receiver power plants receives this benefit during its introductory period. After the mid-1990s, a sufficient number of operating plants will exist to create a substantial industrial base, and mass manufacturing of system components will reduce and stabilize costs.

A statement issued in late 1981 by five utility companies exemplifies broad support for this position. The Arizona Public Service Company, Southern California Edison Company, El Paso Electric Company, Pacific Gas and Electric Company and Sierra Pacific Power Company prepared a series of recommendations concerning federal government involvement in development of solar thermal central receiver technology. The companies stated that, "We believe the solar thermal central receiver technology has real potential for utility use in the 1990's and beyond." One of four specific recommendations the utilities made was the federal government, "Continue and extend, through 1995, the business and investment energy tax credits vital to this industry. This will encourage the transfer of central receiver technology to the private sector through third part investor." The utility companies encourage such action now because their planning horizon has already reached the early 1990s, and they want to be able to rely on a favorable investment climate and a solar industry confidently working toward bringing its technology into commercial use. The tax credits are a vital incentive for development of utility-scale renewable energy systems, and their existence has already had a desireable impact of gaining serious utility consideration of solar thermal electric technology. By the late 1980s and early 1990s this technology will be proven commercially and rate payers will benefit from the lower cost of energy. Further, government tax credit support will no longer be required.

COST AND EFFECT OF EXTENDING THE CREDITS

In a November 1981 report to the Lawrence Livermore Laboratory, "The Cost of Federal Tax Credit Programs to Develop the Market for Industrial Solar and Wind Energy Technologies," the Arthur D. Little Corporation (ADL) concluded that, "the cost of tax credits to the Treasury is amply repaid to the Nation by the value of the energy saved. ...in fact, under the high inflation rate scenerio, the net present value of the increase in revenue due to the decrease in tax deductible corporate expenses for conventional energy is large enough that the Treasury will actually profit on the tax credit program."

An analysis of energy tax credits recently completed by Booz-Allen and Hamilton for the Solar Energy Industries Association agrees with this ADL find and further states that with increased tax credits renewable energy could displace over 30 million barrels of oil annually by 1990; that is about a fifth of a quad. The significance of this is that a fifth of a quad would represent approximately a $10 billion solar energy industry, one which would be a credit to the federal program, to the Congress and to the industry itself. A $10 billion industry by 1990 would represent a twenty-fold increase over the solar energy industry of today.

Additionally, the Booz-Allen and Hamilton Tax credit analysis concludes that:

- Continuing the tax credits for solar and wind technologies would increase their market penetration and support the development of improved technologies at lower cost.
- The benefits derived from the credits would be obtained at "minimal present value cost to the government." The cost of the tax credits would be partially offset by fewer tax deductions taken for conventional fuel expenses by commercial users of renewable energy systems. For the business tax credits, in fact, the study estimates a net revenue gain of more than $600 million in 1990 as a result of the renewable energy credits.

We would be pleased to submit the entire report by Booz-Allen and Hamilton for the record.

CONCLUSION

The Congress must look ahead in its planning for future energy needs in our country. The wisest course is to develop and sustain a balanced program of energy production from all viable sources. The present so-called 'energy surplus' situation will change with time and with any emergency, it could again precipitate a national crisis.

The balanced energy program in the United States must include increasingly, renewable energy sources. Although this nation has invested over a billion dollars in the research, development and demonstration of renewable energy sources, it is only a fraction of the investment already devoted to many other energy forms. Given the importance of energy to our future, it would be foolhardy to reduce investment in an extremely valuable national resource, renewable energy.

The solar tax credits make good economic sense. The tax credits have had a positive effect in accelerating development of solar markets, with improved sales evident now in the residential market. Even greater potential for energy conservation and energy savings lies in the commercial/industrial market. The present 15% business energy credit has promoted solar heating and cooling installations in the commercial/industrial marketplace. However, market penetration will become significantly larger if these credits were increased to parity levels with other energy forms. The business energy tax credit should be increased to 25% and extended through 1990; the 10% investment tax credit should be made applicable to all solar installations in buildings; and the residential credits should be extended to 1990. The tax credits must be seen as a stimulus, and not a drain, on the Treasury. The displacement of expensed conventional fuels and the potential for new sources of taxation, form the movement of products from manufacture to marketing, to the new taxes paid by additional employment, should outweigh any fear of unmanageable short-term revenue loss.

SEIA thanks the Chairman and members of this subcommittee for their strong support for solar energy in the past and pledges its cooperation to work with the subcommittee to develop responsible methods by which the government and the industry can cooperatively move solar energy toward an even greater contribution to our domestic energy development in the future. I will be pleased to answer any questions which you may have.

Mr. FUQUA. Thank you very much, Dr. Weiss, and Mr. Miller.

Dr. Weiss, you mentioned in the Booz-Allen & Hamilton study that by the year 1990, I think, there would be a $600 million gain. Where would the revenue gain come from?

Dr. WEISS. What we are talking about, Mr. Chairman, is the fact that if an industrial customer, one of my companies' industrial customers, were to buy a solar energy system, he would be displacing, typically, maybe 20 percent of his normal conventional fuel requirements. That fuel would have been purchased over the 20-year life of the solar energy system, and would have been expensed as a normal course of doing business.

Rather than that 20 percent, the customer will have bought a solar energy system. He will have depreciated it. He will have taken a 10-percent investment tax credit. And we were assuming, in this analysis, that he would have taken a 25-percent solar energy credit. He would have those credits and depreciation over the first 5 years of life of the system, but you would have to balance on a cash-flow basis the fuel that would no longer be expensed over the life of the system. It is under that condition that, in fact, you have a positive revenue cash flow.

Mr. FUQUA. Well, why should we—and what are the reasons for increasing the business tax credit from 15 percent to 25 percent?

Dr. WEISS. Basically, Mr. Chairman, there have been—as I noted in the testimony—several key events that have essentially eroded the value of our existing tax credits today. Of course, as Mr. Miller has noted, the price of oil has plummeted, including—and I should also note that the price of natural gas has plummeted as well, of course, in many parts of the country, making projects that a year ago were economical far less favorable today.

Similarly, the effect of the TEFRA Act has been to reduce the effective value of solar energy tax credits by approximately 20 percent.

On a very personalized basis, my company calculates that the effect of TEFRA is to force us to reduce our selling price of a project by 14 percent in order to achieve the same return on investment by an investor. So it is for these facts that we feel that we must get an increase in the tax credits in order to simply recoup and stand in place from where we were last year.

Mr. FUQUA. But the solar industry for, say, hot water heaters, in 1978 was about $30 a square foot. Now it is about $60 a square foot, with the tax credit. Now, are you people making a windfall profit, or is that—what has accounted for the doubling of the price, the square-foot price for hot water heaters?

Dr. WEISS. I would venture to say that actually the average installed price for hot water heaters is more like about $45 a square foot nationwide, on a nationwide average, not $60. And, of course, when one factors inflation since 1978–1983 in there, that actually is not really a major price increase. In fact, it probably—that many years, 5 years, of inflation, probably turns out to be somewhat of a decrease.

Now, in the residential hot water systems, of course, one of the major steps that had to have been taken over the last several years is the establishment of a very large infrastructure. Unlike business projects, selling from a company like my own directly to a customer—well, of course, in the residential market one needs distributors, installers, dealers, a whole host of typical consumer-type infrastructure, which takes quite some time to establish.

Mr. **Fuqua**. Mr. Miller, many people think that with decontrol of the oil prices and the Synthetic Fuels Corporation, that we are providing enough incentives for the development of synthetic fuels. They say why do you need a tax credit for that when you have got all these other incentives out there?

Mr. **Miller**. The tax credit and the SFC incentives work together very well. This was what Congress apparently intended, and it has had both of them in place.

As I indicated in my testimony——

Mr. **Fuqua**. I didn't intend that as a hostile question.

Mr. **Miller**. I understand.

The existence of the tax credit simply permits us to do more projects, to build more plants. If the credit weren't there, we would build fewer plants, test fewer technologies, get less production from synthetic fuels in the timeframe we have to operate.

Mr. **Fuqua**. Mr. Bateman?

Mr. **Bateman**. Mr. Chairman, as is not uncommon, I am having a bit of a conceptual problem with something.

Dr. Weiss, you mentioned that through the phenomenon of expensing we were costing the Treasury revenue that it would otherwise receive. I follow that, except for one thing.

It would seem to me that if the relative cost of alternative energy to fossil fuel were less than that for fossil fuel, we wouldn't need tax incentives to encourage alternative energy sources. We need to do that, however, if we are to achieve energy independence, because in today's world, alternative energy sources are more expensive.

Now, if they are more expensive, doesn't the Treasury lose more by expensing those items than it is presently losing by the expensing of traditional sources of fuel? Can you help me out with my conceptual problem?

Dr. **Weiss**. Mr. Bateman, one of the difficulties in comparing a capital intensive, fuel-free technology with one that has to purchase fuel, is that it is very difficult to really determine where the relative merits are. That is, how does one determine that solar energy is, in fact, more or less expensive than conventional fuel, because one has to take——

Mr. **Bateman**. Well, doesn't the marketplace do that?

Dr. **Weiss**. Well, yes; it does, sir. But what I am saying is that in 1978, during the passage of the National Energy Act, when the first renewable tax credits were introduced, one of the purposes behind the introduction of the credit, in addition to simply fostering new technology, was an acknowledged recognition of the fact that the tax code has inherent biases that favor fuel-consuming over fuel-free technologies. So that, in fact, one can make a very strong case that even if prices of renewable energy technology are pushed as low as they can possibly go, that, in fact, unless there are tax credits, the tax code will always provide a disincentive for their use.

And that is essentially what the Booz-Allen study is showing, that one can calculate the break-even point at which, in a zero-inflation scenario, the tax credit is adjusted to a point at which the fuel expensing and the tax credit simply balance out. And I think we actually—from the standpoint of the industry, sir, are very, very close today to that point. I know my company's product best, and I know that with today's presently-legislated tax credit, my company could compete and was competing very favorably with natural gas in California at $5.50 million. Our biggest problem right this second is that in the space of 6 months California natural gas has fallen to something like about $4.30 a million.

Now, we don't expect it to stay there; we expect it to go up and most people do. The question is, will we be in business long enough to see it recover?

Mr. FUQUA. Ms. Schneider?

Mrs. SCHNEIDER. Mr. Chairman, I must admit that the testimony was so very thorough, and the questions prior to my opportunity to ask any questions, that I have nothing further to inquire about. I thank you very much, and I thank the witnesses for their excellent testimony.

Mr. FUQUA. Thank you very much. We appreciate you gentlemen being here today, and thank you for your testimony.

The subcommittee will be adjourned.

[Whereupon, at 12:54 p.m., the committee recessed, to reconvene at the call of the Chair.]

TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

THURSDAY, JULY 21, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Energy Development and Applications,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:35 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the subcommittee), presiding.

Mr. **Fuqua**. The subcommittee will be in order. Without objection, permission will be granted to make photographs and recordings during the course of the hearings.

We are pleased to welcome our witnesses and guests and members to our second hearing on tax incentives for new energy technologies.

As many of you know, the tax credit bill that Mr. Lujan and I introduced this February deals only with solar, wind, geothermal and OTEC property. There are those who feel that we should be extending tax credits for biomass, cogeneration, synthetic fuels, low head hydro and other technologies. There are those who say that it is unfair not to make those tax credits available to the utilities.

Our first panel today will deal with some of these other possible applications for the tax credits. Our second panel will review the results of recent studies of the effects of the solar tax credits, and the experience of private-sector firms with the financing of joint ventures and third-party projects.

We are pleased to welcome back to our subcommittee a number of people who have been here on many occasions: Dr. Lawrence Papay, from Southern Cal Edison; Dr. Bennett Miller, formerly with DOE and now with Fred C. Hart Associates, Inc., Michael Zimmer, of the Cogeneration Coalition.

We are also pleased to welcome Dr. Alan Magerman, of Omnimax, whose experience in developing new energy products will be of great benefit to all of us. I believe you are accompanied by Dr. Beale.

We will begin with you, Larry. I might say to all of the panelists, if you have prepared statements and wish to have them submitted for the record, we will do that. If you wish to summarize, we would be pleased to hear your testimony in that form.

STATEMENTS OF DR. LAWRENCE T. PAPAY, SENIOR VICE PRESIDENT SOUTHERN CALIFORNIA EDISON CO.; DR. BENNETT MILLER, VICE PRESIDENT, ENERGY PROGRAM, FRED C. HART ASSOCIATES, INC.; MICHAEL J. ZIMMER, GENERAL COUNSEL, COGENERATION COALITION, INC.; DR. ALAN P. MAGERMAN, CHAIRMAN OF THE BOARD, OMNIMAX, INC., ACCOMPANIED BY DR. HARRY A. BEALE, DIRECTOR OF RESEARCH, U.S. ENERGY RESOURCES, INC.

Dr. PAPAY. Thank you, Mr. Chairman.

I do have a prepared statement and wish that it be included in the record. I will simply summarize particular aspects of the testimony.

Mr. FUQUA. If you would turn the microphone on. We have a power weakage problem here that——

[Laughter.]

Dr. PAPAY. We do not lack for solar energy today, that is for sure.

In speaking in favor of the tax credits and the particular application from our perspective as a utility, perhaps it would be worthwhile if I were to take just a moment by way of introduction to talk about some of the efforts that we have underway and some of the efforts we would like to see underway and the importance of tax credits to both of these.

As I am sure you are aware, as a company, we have a commitment to the accelerated development and deployment of renewable and alternative resources. This was formalized in a policy statement in late 1980. However, there were programs and projects which preceded that declaration, and today we have in operation, or under construction, a wide variety of renewable and alternative technological projects, including Solar I, which, by the way, is operating very well, two, 10-megawatt high-salinity brine geothermal demonstration plants, participation in the binary cycle 50-megawatt demonstration plant, a 1½-megawatt wind turbine, a 100-megawatt coal gasification project, and a 2-megawatt woodwaste gasifier, to name just a few.

We have a variety of projects involving third parties under PURPA, including nearly 20 contracts involving wind generation, one contract and several other negotiations involving photovoltaics, and a variety of efforts with others involving parabolic troughs, solar dishes, solar ponds, cogeneration and biomass.

The success of our program in the alternatives and renewables is due to the prior Federal program in research and development in these technologies and energy tax credits. However, today, this program is in danger of impairment due to decreased prices for oil, the instability and uncertainty of the credits themselves as far as the current law and beyond 1985.

Our estimate is that the loss of the credits would affect an estimated 1,100 megawatts on our system, which is worth about 4½ million barrels of oil annually.

From a company point of view, we support the various aspects of the energy tax credits and the formal testimony we have submitted gives some suggestions as to percentages and dates as far as extensions are concerned. However, the major point of my testimony, that which I would like to focus on, is the recommendation to extend the business energy tax credits to utilities, thereby increasing their involvement in renewable technologies and helping to ensure the continued development of these technologies.

We have a variety of projects under consideration today, such as a 100-megawatt solar central receiver project, a 50-megawatt solar parabolic trough project, a wind farm involving large machines (a project that could range anywhere from 20 to 100 megawatts) a 50-megawatt high-salinity brine geothermal power plant and several fuel cell demonstration plants, each of which will require, we firmly believe, our participation.

Let me use the 100-megawatt solar central receiver project as an example. This project is under study by ourselves and others and provides a striking example of the current tax credit inequity. During the critical first 5 years of operation, Federal benefits accuring to the nonutility investor will offset approximately 65 percent of the capital investment. However, those same benefits accuring to the utility, and ultimately to our consumer, would offset less than 30 percent of the capital contribution.

More significantly, given the availability of the business energy tax credits to a utility and the 5-year accelerated cost recovery schedule, the cost to the consumer could be reduced up to nearly 2½ cents per kilowatt, or about $5½ million annually.

Alternatively, if we were to finance the project through a subsidiary, current size limitations in PURPA would prevent classification of this project as a qualifying facility and therefore exclude its eligibility for the tax credit. Conversely, if the project were reduced in size in order to qualify as a PURPA-qualifying facility, the economies of scale gained at the larger size would be lost at a corresponding increase in cost to the consumer.

I might point out that in the figures I have presented, the nearly 2½-cent savings by having the utility eligible for the tax credits does not, in essence, form a rate subsidization as might be thought at first blush.

We are talking about new technologies; we are talking about technologies which are above our avoided costs because they are new technologies and the economies of scale in terms of manufacture are not there yet. So the savings to be realized by allowing utilities to be eligible for the tax credits may be the difference as to whether such a project could proceed or not.

Extending the tax credits to utilities, we believe, is logical at this time since they are the ultimate market. They have expertise which can assist in reducing costs in these projects, and they may be necessary, as in this case, to make the project go.

Extending the credits to utilities will result in faster deployment of technologies, provide a more diverse market, and enhance the probability of success.

I should point out that it is our estimate that extending the credits to utilities will not in any way hamper our efforts to work with the individual investor or the small businessman. We would continue working with them, in fact, enhance in some of these projects the very likelihood that some of these projects can proceed.

Thank you very much.

[The prepared statement of Dr. Papay follows:]

STATEMENT OF
DR. LAWRENCE T. PAPAY
SENIOR VICE-PRESIDENT
SOUTHERN CALIFORNIA EDISON COMPANY

Regarding

Tax Incentives for New Energy Technologies

Before the

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

of the

COMMITTEE ON SCIENCE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

July 21, 1983

SUMMARY

Southern California Edison (SCE) supports legislation extending and enhancing energy tax credits for renewable and alternative resource development. Based on our experience and in view of current market conditions and the technological status of these resources, SCE proposes a schedule and level of enhancement as depicted in the table below. Additionally, SCE believes utilities and non-utilities should receive equal incentive to develop these technologies and, as such, recommends that utilities should be eligible for the Business Energy Tax Credit (BETC). Finally, in view of the potential which tar sands, oil shale, and other synthetic fuels offer as an alternative source of energy, SCE urges their accelerated development by making them eligible for the BETC. We believe that this schedule and other policy changes recommended above are necessary to continue and orderly development of renewable and alternative resources.

Business Energy Tax Credits

o	Tar sands, oil shale and other synthetic resources	15 percent
o	Renewable resources	25 percent

Expiration dates for technologies

o	Photovoltaics, solar central receivers, large wind turbines, fuel cells, liquid-dominated geothermal, tar sands, oil shale and other synthetic fuels	1990
o	Biomass, small hydro, solar parabolic dishes and troughs, solar salt gradient ponds, small wind	1988
o	Cogeneration	1985*
o	Affirmative commitment (grandfathering) beyond scheduled expiration	3 Years

Expiration and tax credit conditional on primary fuel source.

Mr. Chairman, members of the Subcommittee, thank you for this opportunity to present the views of the Southern California Edison Company (SCE) on the important subject of tax incentives for emerging energy technologies. I am Dr. Lawrence T. Papay, Senior Vice-President of SCE. As you might already know, we at SCE are committed to the accelerated development and deployment of renewable and alternative energy sources. Our goal for 1992 is to have 2150 MW, or a third of our additional capacity, supplied by renewable and alternative technologies. Thus far we have over 400 MW of renewables and alternatives on-line, and we have contracts with third parties for another 683 MW. An additional 1900 MW of renewable and alternative proposals are under negotiation. We have pursued this policy because of the important benefits associated with these emerging technologies. Our success with renewable and alternative resources has been largely due to the availability of the Federal and State energy tax credits. SCE and other utilities, government, and private parties have made significant progress in developing and using these resources; however, we believe that this progress is now in danger of being severely impeded or even stopped because of uncertainties in several areas of government policy. A major uncertainty is the continued availability of the Business Energy Tax Credit (BETC). We believe that renewable and alternative energy development is an important national goal in which the Federal government must play a key role. Among the most efficient and effective policies necessary to achieve this goal are to:

- Extend expiration dates and adjust percentages for energy tax credits in correspondence with the degree of development of the individual technologies.

- Increase utility involvement in renewable and alternative technologies by extending energy tax credits to utility companies.

- Expand the energy tax credit to include tar sands and oil shale projects, and other synthetic fuels.

- Reinstate energy tax credits for cogeneration facilities.

- Remove certain restrictions to renewable and alternative technology development imposed by the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA).

We believe that energy tax credits are an effective way of enabling the government to foster the development and use of renewable and alternative resources. These credits provide the necessary stimulus for private industry to pursue a particular goal in addition to bringing forth new markets and increased economic activity. Energy tax credits also provide incentives for the private sector to invest in basic and applied energy research, which in the past has been heavily sponsored by the Federal government. Thus, the energy tax credit enhances the development of renewable and alternative technologies and accomplishes this goal by enabling the private sector to invest capital in place of traditional reliance on government.

EXTENSION OF ENERGY TAX CREDITS

While the long-term outlook for renewable and alternative technologies is encouraging, and the potential contribution is substantial, the development of these resources is not without risk. The energy tax credit has undoubtedly provided an effective economic incentive for entrepreneurs to develop these new technologies. In our negotiations with entrepreneurs, many of them stated explicitly that the energy tax credit has been an important, if not deciding, factor in determining whether a project will go forward. We believe that energy tax credits should be extended to ensure financing for energy-saving technologies and assist the private-sector in adjusting to the currently high front-end costs associated with many of these infant technologies. The energy tax credits have provided a degree of stability for these renewable and alternative projects, and have been instrumental in gaining project financing. In fact, we estimate that if the current BETC were not available, SCE would lose access to 1100 MW of capacity, which would displace the equivalent of 4-1/2 million barrels of imported oil per year. Under existing law, inadequate time remains for project planning; thus, the current energy tax credit has become ineffective. We urge you to adopt legislation to extend these credits beyond 1985, so that the national goals as recognized by original Congressional intent can be attained.

TAX CREDIT LEVELS AND DURATION

The BETC law, passed in 1980, has assisted many renewable and alternative technologies in achieving limited commercial market penetration. Many other important technologies, however, remain in the development stage. With the exception of large hydro and dry steam geothermal, none of these technologies has achieved expected competiveness with fossil fuels. To reflect the differences in the stages of resource development and early markets, a resource-specific credit should be created. We recommend that a 15 percent energy tax credit be enacted for tar sands, oil shale and other synfuel projects. A 25 percent energy tax credit would be appropriate for projects using renewable sources of fuel. To reflect the relative maturity of each technology, we propose a technology-specific schedule, based on the current status and expected pace of development for each technology. Projects such as photovoltaics, solar central receivers, large wind machines over 500 KW, fuel cells, liquid-dominated geothermal, oil shale, tar sands and other synthetic fuel projects are currently still in demonstration phases, and require tax credits at least through 1990. Resources which are now in pre-commercial stages, such as biomass, small hydro, solar parabolic dishes and troughs, solar salt gradient ponds, and small wind machines should receive a tax credit through 1988. The further development of cogeneration would be aided significantly if tax credits were made available, with an expiration date and tax credit based on the developmental stage of the primary fuel used. Finally, a three-year affirmative commitment (grandfathering) clause should be added to any energy tax credit legislation so that projects will not be discouraged on the basis of permitting and construction lead-time. We believe that this schedule accurately reflects the present status of the technologies, and will provide sufficient incentive for the private sector to continue an orderly and efficient development of these resources.

Tax credit percentages and appropriate credit expiration dates for emerging technologies are summarized in the following table:

Business Energy Tax Credits

o Tar sands, oil shale and other synthetic resources	15 percent
o Renewable resources	25 percent

Expiration dates for technologies

o Photovoltaics, solar central receivers, large wind turbines, fuel cells, liquid-dominated geothermal, tar sands, oil shale and other synthetic fuels	1990
o Biomass, small hydro, solar parabolic dishes and troughs, solar salt gradient ponds, small wind	1988
o Cogeneration	1985*
o Affirmative commitment (grandfathering) beyond scheduled expiration	3 Years

* Expiration and tax credit conditional on primary fuel source.

UTILITY ELIGIBILITY FOR THE BETC

Although a number of wind and solar projects are moving forward without direct financial involvement by utilities, large renewable and alternative energy projects typically require equity or other forms of capital participation with the utility. This partnership is, however, severely limited due to differences in tax treatment between utilities and non-utilities. Specifically, utilities are not currently eligible to receive the BETC for renewable and alternative energy projects.

Furthermore, under current law utility participation may jeopardize availability of tax benefits to the non-utility partner.

We believe that the market potential and benefits from renewable or alternative energy resources can not be achieved unless the utilities play a much larger role in the finance, construction and ownership of these plants. We further believe that the tax savings resulting from the BETC should ultimately provide benefits to the ratepayer over the useful life of the project. Neither of these objectives can be met unless utilities are provided the same tax benefits available to non-utilities.

A 100 megawatt solar central receiver project under study by SCE and a third-party developer provides a striking example of the current inequity. During the critical first five years of operation, tax benefits accruing to the non-utility investor will offset 86 percent of the non-utility capital investment. Tax benefits accruing to the utility, and ultimately to the utility ratepayer, will offset less than 30 percent of the utility capital contribution. Most significant is that, given the availability of the BETC and five-year Accelerated Cost Recovery Schedule for SCE's investment in the project, the cost to the ratepayer would be reduced by 2.4 cents per kilowatt hour

($5.5 million annually in 1988 dollars).

Alternatively, if SCE were to finance the entire project through a subsidiary, current size limitations in the Public Utilities Regulatory Policies Act (PURPA) would prevent classification of this project as a qualifying facility, and therefore exclude its eligibility for the BETC. Conversely, if the project were reduced in size in order to qualify as a PURPA facility, the economies of scale gained at larger size would be lost, at a corresponding increase in costs to the ratepayer.

We strongly recommend that utilities be allowed the BETC for renewable and alternative energy projects.

REINSTATEMENT OF BETC FOR COGENERATION

The BETC for cogeneration projects should be reinstated to insure a timely development of these fuel-efficient projects. Cogeneration projects entail heavy capital investments and often experience long payback periods. Financial risks are typically high due to fluctuating energy prices and uncertainty of fuel prices and supplies. Therefore, the BETC incentive is an important factor in mitigating the risks perceived by potential investors in the early years of cogeneration projects. As an example, SCE is currently pursuing the development of an approximately 800 MW coal-fired cogeneration project near Bakersfield, California. The availability of the BETC was a critical factor in the financial viability of this $2 billion project. With the expiration of BETC for cogeneration at the end of 1982, future large-scale projects will be far more difficult to finance in the current energy market.

A reinstatement of BETC for cogeneration projects with expiration dates and tax credit levels determined by the primary fuel source will materially increase utility and third-party development of cogeneration projects.

EXTENSION AND ENHANCEMENT OF TAX CREDITS FOR OIL SHALE, TAR SANDS AND SYNTHETIC FUELS

Progress on development of a viable synthetic fuels industry has been slow within the past year, principally because of depressed oil and gas prices. Development has been further hampered by uncertainty in tax credit availability for major synthetic fuel, oil shale and tar sands projects.

Edison supports the affirmative commitment for synthetic fuel projects included in S. 1396 but recommends an increase in the tax credits to 15 percent and an extension of the expiration date through 1990.

ADDITIONAL RECOMMENDED ACTIONS

Many renewable and alternative technology projects have been made uneconomic by the basis reduction, capitalization of interest and property tax expenses, and reduced accelerated depreciation provisions of the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). SCE believes that the restrictive provisions of TEFRA should be rescinded so that the private sector will continue to invest in renewable and synthetic fuel projects.

CONCLUSION

In conclusion, SCE firmly believes the nation cannot afford to abandon what progress has initially been made in the renewable, synthetic fuel, cogeneration, and conservation areas. We simply cannot forget the energy traumas experienced only ten years ago, or certainly we will be doomed to experience them again--perhaps with even greater hardships.

SCE supports enhancement and extension of the BETC, because it has been our experience and is our belief that renewables, synthetic fuels, and cogeneration have a very real role to play in the country's energy future. It is the mutual responsibility of the private sector and the Federal government to bring these about and make them happen. It should be noted that extension of the BETC to utilities would attract a new investment sector, and assist in the accelerated development of a viable renewable and alternative industry, through increased investment, diversity and investor competition.

While the suggestion to extend the BETC will indeed benefit SCE, the ultimate objective is to encourage the development and commercialization of alternate and renewable technologies. In so doing, every available resource should be utilized including the expertise, knowledge, capital, and existing infrastructure of the utility industry. Further, the diverse nature of the industry itself helps ensure development of a wide range of technologies.

BIOGRAPHICAL SKETCH
LAWRENCE T. PAPAY

Dr. Lawrence (Larry) T. Papay, born in New Jersey, earned a Bachelor's Degree in Physics from Fordham University and a Master's and Doctorate in Nuclear Engineering from the Massachusetts Institute of Technology. He is a Registered Professional Nuclear Engineer in California.

Dr. Papay began his career with the Southern California Edison Company in 1970 as Director of Research and Development. In 1978, he was assigned to the position of General Superintendent to manage utility bulk power operations. He was elected Vice President in January, 1980, at which time he assumed management of the utility's research and development, and quality assurance organizations. On May 19, 1983, the Board of Directors elected Dr. Papay Senior Vice-President. Currently, the Advanced Engineering, Engineering and Construction, and System Development Departments report to him.

In the past, Dr. Papay has served with the Federal Office of Technology Assessment, Solar Advisory Panel; Federal Power Commission's Technical Advisory Committee on Research and Development; U.S. Department of Energy Solar Research and Development Panel of Energy Research Advisory Committee; National Science Foundation Solar Energy Panel; Electric Power Research Institute (EPRI Advanced Power Systems Divisional Committee; EPRI Energy Analysis and Environment Divisional Committee; EPRI Steam Generators Owners Group; EPRI Fuel Cell Users Group Management Committee; Editorial Advisory Boards for the Solar Law Reporter and the Energy Resources; and Massachusetts Institute of Technology Corporation Visiting Committee for the Department of Nuclear Engineering.

Dr. Papay is presently a member of the American Nuclear Society; Pacific Coast Electrical Association; National Science Foundation Industrial Panel on Science and Technology; California State Polytechnic University, Pomona, School of Science Advisory Council; Renewable Energy Institute Board of Directors; Edison Electric Institute Research Management Subject Area Committee; and is chairman of the EPRI Research Advisory Committee.

Dr. Papay resides with his family in Arcadia, California.

Mr. FUQUA. Thank you very much.

Bennett.

Dr. MILLER. Mr. Chairman, it is a pleasure to be here this morning. Thank you for inviting me to testify. For those of you who do not know me, my name is Bennett Miller, and I am here today on behalf of the National Wood Energy Association, which is an association of industrial firms interested in promoting the environmentally sound use of our nation's vast wood resources.

The National Wood Energy Association, which was reconstituted this spring under new leadership, and of which I am currently vice-chairman, now has over 100 members from 43 States around the country and we anticipate that our membership will grow over the next six months to more than 200 members.

I am also vice president of Fred C. Hart Associates, a New York-based energy and environmental consulting firm with an office in Washington for which I am responsible.

This morning, Mr. Chairman, I will address the need to extend the current tax incentives for wood-based energy systems and the need to adjust what we believe are oversights in the existing legislation.

The National Wood Energy Association believes that there have been misunderstandings in the past regarding the commercial nature of wood-based energy technologies and that these misunderstandings have resulted in significant inequities and disincentives to invest in such systems.

This is especially disturbing in the context of the potential of wood to impact on our national energy supply system. Congress own Office of Technology Assessment estimates that our national inventory of commercial and noncommercial timber is over twice our proven reserves of natural gas, and as a nation, we are adding several percent to that inventory each year.

Of course, not all this inventory is available for energy production, but some fraction of it is, and it is available each and every year. It is generally acknowledged by the Office of Technology Assessment and by the Department of Energy that wood can provide up to 10 quads per year with today's technology or relatively straightforward extensions of it.

Our wood feedstock base, therefore, is a major one. In fact, today it is already contributing about 2.2 quads to our primary energy supply, over 3 percent of the Nation's overall primary energy consumption.

Almost all of this consumption comes from wood and wood waste utilized by the forest products industry, which is consuming about 1.3 quads of that resource, thereby liberating a like amount of conventional fuel, and in the residential sector, where we are consuming about 0.9 quads in the increasingly popular airtight wood stoves.

One may ask, then, why are we concerned about tax incentives for wood-based systems if they are already generating 2.2 quads of energy? The answer is really quite simple. The forest products industry has just about used up all its free wood waste. In fact, many new wood-fired installations, even in the forest products industry, are relying on purchased fuel. The residential wood market is very nearly saturated.

From here on, the economics of wood systems will depend on paying for wood fuel and competing with cheaper conventional fuels. We are at a stage in our development of wood energy that is identical to where the country was in the mid-1970's with respect to industrial conservation. We have done the easy conversions; that is, the conversions that are the equivalent of insulating attics and hot water pipes, of double-glazing windows and the like.

We are now at a point where the economics of each system has to be considered as a whole without any "freebies." In this environment, wood-fueled systems are no longer the runaway winners they were when fuel was free; and yet the potential for wood replacing conventional fuel is still significant and important in the context of our overall national goal of being energy self-reliant.

In the industrial sector alone, there are over 50,000 boilers that are currently burning oil and natural gas which could be converted to burn wood or a byproduct of wood. These boilers consume approximately 5 to 6 quads of expensive energy per year.

In short, in the industrial sector, there is a potential for three times the current consumption of wood, but it is not happening, not at all. Outside the forest products industry, there are very few wood-fueled systems. A qualitative change in the marketplace has developed as the forest products industry has completed the easy conversions.

If we are to take advantage of our major untapped wood energy resource, we must make the next round of conversions more attractive to industry than they currently are. How we do it is the issue I would like to address.

But first let me say a word about how wood can be converted to energy. There are many ways and many conversion technologies. This fact often leads to confusion when the issue is that of providing incentives. Therefore, I will discuss the two that are closest to the marketplace: burning wood directly to product heat, and burning it in an oxygen-starved environment, called gasification, to produce a synthetic gas that is, in all respects, identical to coal gas except that it is much cleaner.

In the spectrum from research to commercialization, these two ways of using wood, direct combustion and gasification are closest to commercialization. My remarks will be directed primarily to them, but obviously, to the extent that they have any merit when applied to technologies that are nearly commercial, they have at least equal merit when applied to technologies that are farther removed from the marketplace.

Direct combustion and gasification fit very well into industrial applications. Boilers that burn oil or natural gas can be easily retrofit to burn wood gas. New boiler installations can be easily designed for direct combustion, but these conversions are not being pursued by industry. This paradox; namely, that there are supposedly economic technologies available today to convert wood to energy and yet they are not being utilized, has a simple explanation.

Industrial users are reluctant to convert wood-fueled systems for three reasons: First, they are uncertain of the availability of supply; second, many are basically unaware of the state-of-conversion technology and need to be convinced that it is real; third, for those who are aware of the conversion technology and are, in fact, convinced of the availability of supply, the overall economics tends to be marginal when fuel has to purchased.

This is not to suggest that these systems do not make sense. They do. But in general, they are sufficiently close to the margin that an energy user is reluctant to take the step to convert from conventional fuels to wood. This is particularly true today with the current moderation in oil prices and the uncertainty regarding natural gas deregulation.

Compounding this problem is the fact that current legislation actually discriminates, surprisingly, against one of these technologies, against wood gasification. The Energy Tax Act of 1978 excludes gasification from the energy tax credit. It was not meant to do so. The history is quite clear on that.

But in point of fact, when the tax incentives for renewables were originally crafted, synthetic gas from biomass was excluded. Whatever else Congress intended, in 1979 and 1980, they did not intend to exclude these systems. They were just then beginning to emerge as a potentially attractive alternative to burning oil and natural gas. It was, in our opinion, an oversight.

When you put all these factors together: Moderating conventional fuel prices; investor concern about feedstock availability; unawareness of the state of the art; and legislation which excludes an emerging option, we have a situation where the marketplace will not respond unless some incentives are provided and a stable financial and technological environment is assured.

The extension of the energy tax credit, coupled to a technical correction that insures wood gasifiers the same advantage that other systems enjoy, is one such vehicle.

In my judgment, Mr. Chairman, action on the part of the Congress to extend the credits and correct the legislation will produce a much more aggressive movement on the part of energy users to convert to wood use.

Why can I state this so confidently? I would like to cite a number of examples of major industrial users of energy who have chosen to install wood-burning systems because of the availability of the energy tax credits, and who have indicated to us explicitly that they would not have done so, or would have agonized over the decision without that credit. Let me give you several.

The Packaging Corp. of America's 90-megawatt partially wood-fired plant in Counce, Tenn., which has recently been approved for construction, probably would not have proceeded if it were not for the energy tax credit.

The installation of a 20,000-pound-per-hour wood-fired steamplant at the White Pine Copper Mine in White Pine, Mich., would not have proceeded if it were not for the availability of the energy tax credit.

Two 10-megawatt, wood-fired systems being constructed by Ultrapower, Inc., in California could not have been financed without the energy tax credit; nor could two similar systems about to be constructed by that company, or six in project development. All of them are only financeable with the credit.

The availability of the energy tax credit played a major role in insuring the financing of a small gasifier in New Berlin, N.Y.

The AMFAC Corp. has stated in a recent letter to your colleagues in the Senate that its ambitious plans to convert to biomass fuel systems will be seriously impacted if the energy tax credit is allowed to expire.

There are many other examples that I can cite from our records. Suffice it to say that in the industrial sector, wood could conceivably contribute several more quads to our energy supply. This would relieve pressure on oil and natural gas and circulate money and create jobs in the local economy.

These installations are only going forward, however, because of the energy tax credit. They will not go forward without it.

I believe, Mr. Chairman, that at this point, the extension of the energy tax credit is essential to help continue this transition from conventional hydrocarbon fuels to wood fuels, where such conversions make sense.

I believe that in the next 7 or 8 years, through 1990, enough of these systems will be installed that the industrial community will then be able to make choices on their own without the tax credit. They will have seen enough of them to be relieved of their original concerns regarding feedstock availability, equipment reliability, and overall economic attractiveness.

Until that time, however, the energy tax credit is absolutely crucial to providing the impetus for effective wood energy use.

Mr. Chairman, to this point, I have purposely focused my remarks on wood and wood-fueled systems because I believe the issues surrounding the extension of the tax credit for biomass in general are often linked to concerns regarding wood.

In closing, I would like to provide some perspective on the overall biomass issue. When our attention extends beyond wood, the resource base expands quite dramatically. To the total of commercial and noncommercial timber can be added the energy value of agricultural crops and residues that are estimated to be at least one and perhaps as many as five quads per year.

To that, the value of animal and agricultural wastes can add an additional one quad. Aquatic and emergent systems, which are still in the research phase, probably have potential in the multiquad range.

This Nation enjoys a significant reserve of biomass that can be used for energy. The technologies to convert this resource economically to energy are in various stages of development. Some are closer to the marketplace, some are farther away.

Anaerobic digestion of animal and agricultural waste is one that is closer. It, like wood gasification, has suffered from what we believe is the same oversight that excluded gasifiers from the energy tax credit. A technical correction, we believe, is in order here as well.

Mr. Chairman, I appreciate the opportunity to testify here this morning, and of course, I will be glad to answer any questions that you may have.

Thank you.

[The prepared statement of Dr. Miller follows:]

Testimony

before

Subcommittee on Energy Development and Applications
Committee on Science and Technology
U.S. House of Representatives

on

Tax-Incentives for New Energy Development

Bennett Miller
Vice Chairman
National Wood Energy Association

and

Vice President/Energy Programs
Fred C. Hart Associates, Inc.

July 21, 1983

Good Morning Mr. Chairman.

Thank you for inviting me here to testify before your committee. My name is Bennett Miller and I am here today on behalf of the National Wood Energy Association, a growing association of industrial firms interested in promoting the environmentally sound use of our nation's vast wood resources. The National Wood Energy Association, which was reconstituted this Spring under new leadership, now has over a hundred members from forty three states around the country, and we anticipate that our membership will grow, over the next six months, to more than two hundred members. I am also Vice President of Fred C. Hart Associates, Inc., a New York-based energy and environmental consulting firm with a major office in Washington for which I am responsible.

This morning, Mr. Chairman, I will address the need to extend the current tax incentives for wood-based energy systems and the need to adjust what we believe are oversights in the existing legislation. The National Wood Energy Association believes that there have been misunderstandings in the past regarding the commercial nature of wood based energy technologies and that these misunderstandings have resulted in significant inequities and disincentives to invest in such systems.

This is especially disturbing in the context of the potential of wood to impact on our national energy supply system. The Congress' Office of Technology Assessment estimates that our national inventory of commercial and non-commercial timber is over twice our proven reserves of natural gas, and as a nation we are adding several percent to that inventory each year.

Of course not all of this inventory is available for energy production, but some fraction is, and it is available each and every year. It is generally acknowledged by the Office of Technology Assessment and by the Department of Energy that wood can provide up to ten quads per year with today's technology or relatively straightforward extensions of it. Our wood feedstock base, therefore, is a major one; in fact, today, it is contributing about 2.2 quads to our primary energy supply -- over 3% of the nation's overall primary energy consumption. Almost all of this consumption comes from wood and wood waste utilized by the forest products industry, which is consuming about 1.3 quads of that resource thereby liberating a like amount of conventional fuel, and in the residential sector, where we are consuming about 0.8 quads in the popular air tight wood stoves.

One may ask, then, why are we concerned about tax incentives for wood-based systems if we are already generating 2.2 quads of energy from wood? The answer is quite simple. The forest products industry has just about used up all its free wood waste -- in fact, many new wood fired installations in the forest products industry rely on purchased fuel -- and the residential wood market is very nearly saturated. From here on, the economics of wood systems will depend on paying for wood fuel and competing with cheaper conventional fuels. We are at a stage in our development of wood energy that is identical to where the country was in the mid-1970's with respect to industrial conservation. We have done the easy conversions -- the conversions that are the equivalent of insulating attics and hot water pipes, of double glazing windows and the like. We are now at the point where the economics of each system has to be considered as a whole, without any "freebies." In this environment, wood fueled systems are no longer the runaway winners they were when fuel was free; and yet the potential for wood replacing conventional fuel is still significant and important in the context of our overall national goal of being energy self reliant. In the industrial sector, alone, there are over 50,000 boilers that are currently burning oil and natural gas which could be converted to burn wood or a by-product of wood. These boilers consume approximately 5 to 6 quads of expensive energy per year. In short, in the industrial sector, there is a potential for 3 times the current consumption of wood, but it's not happening -- not at all. Outside the forest products industry there are very few wood-fueled fired systems. A qualitative change in the marketplace has developed as the forest products industry has completed the easy conversions. If we are to take advantage of our major, untapped wood energy resource, we must make the next round of conversions more attractive to industry than they currently are. How we can do it is the issue that I would like to address now.

But first, let me say a word about how wood can be converted to energy. There are many ways and many conversion technologies. This fact often leads to confusion when the issue is that of providing incentives. Therefore, I will discuss the two that are closest to the marketplace -- burning wood directly to produce heat; or burning it in an oxygen-starved environment which produces a synthetic gas that is, in all respects, identical to coal gas except that it is much cleaner. In the spectrum from research to commercialization, these two ways of using wood, direct combustion and gasification, are closest to commercialization. My remarks will be directly primarily to them, but, obviously, to the extent that they have any merit when applied to technologies that are nearly commercial, they have at least equal merit when applied to technologies that are farther removed from the marketplace.

Direct combustion and gasification fit very well into industrial applications. Boilers that burn oil or natural gas can be easily retrofit to burn wood gas. New boiler installations can be easily designed for direct combustion. But these conversions are not being pursued by industry. This paradox, namely that there are supposedly economic technologies available today to convert wood to energy and yet they are not being utilized, has a simple explanation.

Industrial energy users are reluctant to convert to wood-fueled systems for three reasons. First, they are uncertain of the availability of supply. Second, many are basically unaware of the state of conversion technology and need to be convinced it is real, and, third, for those who are aware of the conversion technology and are, in fact, convinced of the availability of supply, the overall economics tends to be marginal when fuel has to be purchased. This is not to suggest that these systems do not make sense. They do, but, in general, they are sufficiently close to the margin that an energy user is reluctant to take the step to convert from conventional fuels to wood. This is particularly true today with the current moderation in oil prices and the uncertainty regarding natural gas deregulation. Compounding this problem is that fact that current legislation actually discriminates, surprisingly, against one of these technologies -- against wood gasification. The Energy Tax Act of 1980 excludes gasification from the energy tax credit. It was not meant to do so -- the history is quite clear on that

-- but, in point of fact, when the tax incentives for renewables were originally crafted, synthetic gas from biomass was excluded. Whatever else Congress intended in 1979-80, they did not intend to exclude these systems They were just beginning to emerge as a potentially attractive alternative to burning oil and natural gas. It was an oversight.

When you put all these factors together -- moderating conventional fuel prices, investor concern about feedstock availability, unawareness of the state-of-the-art, and legislation that excludes an emerging option -- we have a situation where the marketplace will not respond unless some incentives are provided and a stable, financial and technological environment is asssured. The extension of the energy tax credit coupled to a technical correction that ensure that wood gasifiers can enjoy the same advantage that other systems enjoy is one such vehicle.

In my judgement, Mr. Chairman, action on the part of the Congress to extend the credits and correct the legislation can ensure a much more aggressive program on the part of energy users to convert to wood use. Why can I state this so confidently? There are a number of examples that I would like to cite of major industrial users of energy who have chosen to install wood burning systems because of the availability of the energy tax credits and who have indicated to us, explicitly, that they would not have done so, or would have agonized over the decision, without that credit. Let me give you several.

- The Packaging Corporation of America's 90 MW wood fired plant in Counce, Tennessee, which has recently been approved for construction, probably would not have proceeded if it were not for the energy tax credit.

- The installation of a 20,000 pound per hour wood-fired steam plant at the White Pine Copper Mine in White Pine, Michigan would not have proceeded, if it were not for the availability of the energy tax credit.

- Two, 10 MW, wood-fired systems being constructed by Ultrapower, Inc. of California could not have been financed without the energy tax credit; nor could two similar systems about to be constructed by that company, or six in project development. All of them are only financiable with the credit.

- The availability of the energy tax credit played a major role in ensuring the financing of a small gasifier in New Berlin, New York.

- And, the AMFAC Corporation has stated in a recent letter to your colleagues in the Senate that its ambitious plans to convert to biomass-fueled systems will be seriously impacted if the energy tax credit is allowed to expire.

There are many other examples that I can cite from our records. Suffice it to say, that in the industrial sector, where wood could conceivably contribute several more quads to our energy supply, thereby relieving pressure on oil and natural gas, and circulating money and creating jobs in the local economy, installations are going forward because of the energy tax credit. They will not go forward without it.

I believe, Mr. Chairman, that at this point in time, the extensive of the energy tax credit is essential to help continue this transition from conventional hydrocarbon to wood fuels, where such conversions make sense. I believe that in the next seven or eight years, through 1990, enough of these systems will be installed that the industrial community will then be able to make choices on their own without the tax credit because they will have seen enough of them to be relieved of their original concerns regarding feedstock availability, equipment reliability, and overall economic attractiveness. Until that time, however, the energy tax credit is absolutely crucial to providing the impetus for effective wood energy use.

Mr. Chairman, to this point, I have purposely focused my remarks on wood and wood fueled systems because I believe the issues surrounding the extension of the tax credit for biomass are often linked to concerns regarding wood. In closing, I would like to provide some perspective on the overall biomass issue. When our attention extends beyond wood, the resource base expands quite dramatically. To the total of commercial and non-commercial timber, can be added the energy value of agricultural crops and residues that are estimated to be at least one, and perhaps as many as five, quads per year. To that, the value of animal and agricultural wastes can add an additional 1 quad to our energy inventory and the value of aquatic and emergent systems, which are still in the research phase, is probably in the multi-quad range.

This nation enjoys a significant reserve of biomass that can be used for energy. The technologies to convert this resource economically to energy are in various stages of development -- some closer to the marketplace, some farther away. Anaerobic digestion of animal and agricultural waste is one that is closer. It has suffered like wood gasification from what we believe is the same oversight that excluded gasifiers from the energy tax credit. A technical correction is in order.

Mr. **Fuqua**. Thank you very much, Bennett.

Mr. Zimmer.

Mr. **Zimmer**. Thank you, Mr. Chairman.

My name is Michael J. Zimmer. I currently serve as secretary and general counsel of the Cogeneration Coalition, which is a nonprofit organization comprised of interested natural gas utilities, industrial users, industrial and commercial equipment manufacturers, project developers and engineering and construction firms in the field of cogeneration development. Many of our member companies are some of the larger, more active companies currently in this field.

Mr. Chairman, cogeneration is one of the foremost technologies for the efficient use of energy currently available in the United States. Major potential exists in the forest products, steel, food processing, chemical and petroleum refining industries for the application of this energy efficiency technology.

Other potential applications for cogeneration exist of a nonindustrial nature, including potential usage in water desalinization plants, waste water treatment facilities, pipeline compressor stations, multifamily residential and commercial complexes, hotels, universities, hospitals and military bases.

By 1982, use of cogeneration had increased to levels representing almost 5 percent of total U.S. electricity production, or approximately 113 billion kilowatts, from prior levels of 3 percent which existed prior to the enactment of the Public Utility Regulatory Policies Act (PURPA) by the Congress in 1978.

Under a proper regulatory environment and with reinstatement of business energy tax credits for such cogeneration investments, the market for installation and construction of such systems could increase from current levels of approximately $750 million to levels reaching $20 to $30 billion by 1990.

The membership of the coalition, Mr. Chairman, supports the role of tax incentives for new energy technologies. This critical review undertaken by your subcommittee of the availability of energy tax credits and their role in developing and commercializing energy technology is timely. Many renewable energy and cogeneration projects are entering critical decisionmaking on ultimate development and construction during the remainder of this decade.

We are living currently within this industry in an environment where the Congress permitted the expiration of the cogeneration tax credit to occur after only 2 years of availability on December 31, 1982. With that expiration, a distinct market response ensued as development activities flattened during the first half of this year. Financial institutions, in many instances, increased their discount rates for such projects and internal corporate hurdle rates increased as well.

With the introduction of legislation currently pending before the Congress and with several other developments including those associated with the rendering of the decision by the Supreme Court in the *American Electric Power* case, market interest has renewed within the past several months.

In order to maintain this momentum, we submit it is essential that action on renewal of the cogeneration tax credit be considered this year to maintain the continuity and current development patterns for this energy-efficient technology, as well as to preserve commensurate returns on such investments with other investment alternatives.

Further delay until 1984 would only operate to create increased difficulties in the private financing of these projects. Since most of this financing will occur through third parties, the role of tax incentives and the necessity for stability in tax planning becomes paramount at this time.

On page 6 of our testimony, Mr. Chairman, we review very briefly some of the critical risk factors which are utilized and evaluated by financial institutions as they are reviewing projects of this nature. Review of these factors provides some interesting background in terms of showing the value and role of energy tax credits as a critical element of a national energy policy.

Briefly, those risk factors include the technical risk associated with the technology, review of the market risks, economic risks, financial risks, supply risks associated with the fuel feedstocks that are going to be used in the project, the risk that the project may never be completed, or in the alternative, be subjected to excessive delays as it is moving into construction and ultimate operation, and finally, regulatory and operating risks associated with these projects.

The extent to which these relative risks are perceived is a function of the quality and the maturity of these technologies and principles of underlying economics. Many cogeneration projects are perceived by investors and financial institutions as risky, requiring a rate of return which can exceed the return available on more conventional investment opportunities. These rates of return to attract risk capital range from levels of 25 to 30 percent, while for comparative purposes, the current rates of return on equity after tax for large-size American companies currently ranges from 12 to 15 percent.

Another evaluative criterion with respect to these projects must include an assessment and awareness that the energy marketplace in this country is not totally a free market for the provision of electricity, natural gas, and in some respects, coal, because of problems associated with rail rates.

Tax incentives operate in three distinct manners to address these concerns. They rectify these types of imbalances in our underlying economic system; second, they address the perceived risks associated with these technologies, which I have just reviewed, by offering a premium incentive for investment in such projects; and third, the tax credit offsets the tax benefits of expensing the usage of fuels by business in general.

Moreover, reduced energy costs have the potential to reduce tax deductions in deriving taxable income with positive feedback effects which offset revenue losses from the tax credits themselves, on which you will be hearing greater details later this morning from other witnesses.

This means that for every dollar of energy saved by the investment, the Treasury Department, in effect, recovers increased tax revenues—revenues which would not have been collected but for the energy-saving capital expenditure.

The availability of energy tax credits becomes critical in terms of financing these projects for three reasons: First, the credit is a self-implementing exercise and does not necessitate the development of a large infrastructure to implement the program; second, it is available on a timely basis when the cogeneration system is placed in service and is valued at close to net present value, unlike depreciation allowances, which are recovered, instead, over a 5-year period; third, its value to the taxpayer, unlike depreciation allowances, is constant and is not contingent upon the marginal tax rate of the particular investor.

These factors are more critically important because analysis indicates that over the long term, almost 66 percent of these investments in cogeneration systems will involve third-party ownership and operation, at least for gas-fired systems, based upon recent analysis conducted for the Argonne National Laboratory.

The impact of tax credits for such technologies as cogeneration has proved an important tool in arranging financing for projects and has helped in stimulating capabilities to attract risk capital to these projects. However, the full value of these provisions, and this applies to the other renewable energy tax credits as well, as an incentive and as a reflection of congressional intent in support of those technologies has been thwarted over the past several years, as outlined on page 10 of our testimonus by several factors.

First, the failure of the Internal Revenue Service to properly interpret or to meaningfully implement such provisions; second, continue to tax by this administration against the continuation of the energy tax credits; third, the imposition of expiration dates coupled with restrictive IRS interpretations on such issues as affirmative commitments provisions; and fourth, potential shifts in Treasury IRS policies regarding the tax credits, potential for restrictive treatment of accelerated depreciation insofar as it might apply to investments in cogeneration in alternative energy projects whereby such property potentially could have been treated as public utility property, or where such property is installed in tax-exempt or in municipal entities.

In that regard, I would like to close by briefly mentioning legislation that is pending before this Congress which would have negative implications for cogeneration and renewable energy development where tax leasing is involved by tax-exempt institutions and governmental entities. This would be accomplished in these various bills by generally lengthening the period over which the owner of such property used by a tax-exempt entity may claim the cost recovery deductions with respect to the property and by tightening the criteria that are used in distinguishing a lease from a service agreement.

The Cogeneration Coalition, as part of a larger group effort within the renewable energy industry, endorses efforts to curb tax-abuse situations which arise out of such leasing agreements. However, we submit that most of the situations that have been characterized as abuses have arisen outside the context of the growing energy and renewable energy industries, and we believe that certain provisions in these bills demand reconsideration.

We would urge this committee to assume a leadership role in expeditiously making constructive recommendations on these issues to the House Ways and Means Committee as they continue their deliberations and review of these questions.

Any legislation in this area regarding leasing by these types of institutions should clearly reaffirm and not alter the criteria applied under current law to distinguish service contracts from leases with respect to these types of energy projects.

These criteria currently provide the IRS with an adequate means to distinguish legitimate service contracts from leases. At the same time, they have created a set of standards which have allowed cogeneration project developers, and I would add, other alternative energy developers, to enter into contractual arrangements with tax-exempt organizations and governmental entities with reasonable certainty as to their ultimate classification for tax purposes.

There are other regulatory issues of a nontax nature, Mr. Chairman, which I have not discussed this morning. I would be glad to discuss these in the question and answer session that will follow or submit further information for the record if the chairman deems it appropriate or useful.

I would like to close by referring briefly to an article that just appeared earlier this month in the Wall Street Journal, authored by Henry M. Schuler, who is a senior fellow for energy and security studies at the Georgetown Center for Strategic and International Studies.

Mr. Schuler, in his article, highlights recent headlines that I think we have all been familiar with, such as "More Utilities Shun Coal Conversion as Economic Benefits Start to Fade." Another headline cited regards "Nuclear Power Firms Have Cancelled 45 Percent of Orders Since 1972." The message, according to Mr. Schuler, is that "the Nation's fuel options are being dangerously narrowed. In fact, there may already be no acceptable option for large new industrial boilers and generators. This potentially disastrous situation arises from the fact that renewable energy substitutes are not yet technologically feasible or necessarily commercially viable on the necessary scale, while the only fossil fuel alternatives to coal are legislatively prohibited or discouraged."

This, in summary fashion, Mr. Chairman, I think provides cogent support for the hearings and the focus which you have brought to bear on these issues this morning.

In this regard, we urge that the Congress and the administration assume the initiative on these questions rather than waiting until being placed on the defense later this decade by inevitable shifts in the domestic and international markets in which we are all operating.

We thank you for the opportunity of being here today and will be glad—to answer any questions you may have.

[The prepared statement of Mr. Zimmer follows:]

WRITTEN TESTIMONY
OF
MICHAEL J. ZIMMER
SECRETARY AND GENERAL COUNSEL

OF

THE COGENERATION COALITION, INC.

ON

TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

BEFORE THE

HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

JULY 21, 1983

SUMMARY

WRITTEN TESTIMONY
OF
MICHAEL J. ZIMMER
COGENERATION COALITION, INC.
ON
TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES
JULY 21, 1983

- Cogeneration is one of the foremost technologies for the efficient use of energy currently available in the United States. Major potential exists in the forest products, steel, food processing, chemical and petroleum refining industries for the application of this technology.
- DOE has recently concluded that 52% of the potential cogeneration by industry will occur in the South Atlantic, South West and Western regions. Twenty-five percent (25%) of the potential is in the Mid-Atlantic region alone.
- Cogeneration now provides 5% of total U.S. electricity production or approximately 113 billion kilowatt hours. Under a proper regulatory environment and with extension of appropriate tax incentives, installation and construction of cogeneration systems could increase from current levels of $750 million to $20 to $30 billion by 1990.
- The Cogeneration Coalition, Inc. believes this review undertaken by the Subcommittee on the availability of energy tax credits is timely as many renewable energy and cogeneration projects enter critical decision-making on ultimate development and construction. Larger-scale energy projects may also require significant lead times with substantial front-end capital requirements which the availability of energy tax credits can offer a significant contribution.
- Tax incentives are necessary to rectify current imbalances in the economic system, to address the perceived risks associated with these technologies by offering a premium incentive for investment in such projects, and to offset the tax benefits of expensing usage of fuels by business.
- Legislation such as H.R.3072 and S.1305 embodies a broader more comprehensive approach to energy tax credits than other legislation pending before this Subcommittee, and would reinstate the cogeneration tax credit which was permitted to expire on December 31, 1982.

- The Cogeneration Coalition, Inc. particularly supports the removal of the oil and gas limitation under old law governing the cogeneration tax credit. Omitting oil and gas or any of their products as primary fuels for purposes of the cogeneration tax credit is counterproductive since the most effective and currently available cogeneration technologies are gas-fired.

- The Congress is currently considering legislation such as H.R.3110 and S.1564 which could have a very negative impact on use of these technologies where leasing is involved by tax-exempt institutions and government entities to finance installation of cogeneration systems.

- In regard to leasing by such tax-exempt institutions, the Coalition urges that any legislation on this issue should clearly reaffirm, and not alter, the criteria applied under current law to distinguish service contracts from leases.

WRITTEN TESTIMONY
OF
MICHAEL J. ZIMMER
SECRETARY AND GENERAL COUNSEL
OF
THE COGENERATION COALITION, INC.
ON
TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

BEFORE THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
JULY 21, 1983

The following written testimony is filed on behalf of the Cogeneration Coalition, Inc. (Coalition) on Tax Incentives for New Energy Technologies which is an issue currently pending for review before this Subcommittee. The Coalition is a non-profit organization comprised of interested natural gas utilities, industrial users, industrial and commercial equipment manufacturers, project developers and engineering and construction consulting firms. 1/ The Coalition has also established advisory working relationships with other national interest groups and trade associations on issues affecting cogeneration development. The Coalition supports the provision of necessary financial and tax incentives to promote the full utilization of cogeneration technology and the removal of unnecessarily restrictive federal barriers to the development of cogeneration potential nationwide.

Introduction

Cogeneration is one of the foremost technologies for the efficient use of energy currently available in the United States. It involves the sequential use of energy to produce electricity or mechanical shaft power and some other useful form of energy (usually heat or steam) from the same energy source. Major potential exists in the forest products steel, food pro-

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1/ The current membership of the Coalition includes: Kimberly Clark Corp., Brooklyn Union Gas Company, Great Lakes Carbon Corp., Thermo Electron Corp., National Urban Energy Corp., Big Six Towers, Williams & Works Industrial CoEnergy Systems, Inc., Michigan Consolidated Gas Company, Hydra Co. Enterprises, Inc. and Southern Connecticut Gas Company as well as several other national trade groups and organizations supporting cogeneration development.

cessing, chemical and petroleum refining industries for the application of this technology.2/

A recent study for the Department of Energy (DOE) on Industrial Cogeneration Potential (1980-2000) evaluated sixteen cogeneration technology/fuel combinations at 10,000 plant sites throughout the country. Based upon this analysis, 3131 plant sites were identified as viable candidates for such projects. These plants represented the maximum potential within the scope of this study based on a heat match analysis, utility rates, and accelerated depreciation and offer 42,824 megawatts of electric power--or the equivalent of 40-50 baseload powerplant generation stations. (See Attachment 1)

These plants also represent approximately 2 quads of potential energy savings including the energy savings at the plant site as well as the utility powerplant. DOE also concludes that 52% of the potential cogeneration will occur in the South Atlantic, South West, and Western regions. Twenty-five percent (25%) of the potential is in the Mid-Atlantic region spreading into New England. (See Attachment 2) California has the largest potential of 8,537 MW followed closely by Louisiana (6,202 MW), Texas (5,878 MW), Pennsylvania (4,172 MW), Illinois (2,452 MW), New Jersey (2,323 MW) and Ohio (2,280 MW). (See Attachment 3)

Other potential applications for cogeneration of a non-industrial nature include water desalinization plants, pipeline compressor stations, multi-family residential and commercial complexes, hotels, universities, hospitals and military bases.3/ For instance, Hagler, Bailly & Co. estimates there is currently about 560 MW of commercial/residential cogeneration capacity currently installed at about 300 sites across the U.S.

By 1982, use of cogeneration surged to levels representing 5% of total U.S. electricity production or approximately 113 billion kilowatt hours from prior levels of 3% which existed prior to enactment of the Public Utility Regulatory Policies Act (PURPA) of 1978. Under a proper regulatory environment and with reinstatement of energy tax credits for such investments, the market for installation and construction of cogeneration systems could increase from current levels of approximately $750 million to levels of $20 to $30 billion by 1990.

2/ See Resource Planning Associates, The Potential for Industrial Cogeneration Development by 1990 (July 31, 1981), p.ii.

3/ For more detailed analysis of non-industrial cogeneration applications, see OTA, Energy Efficiency of Buildings in Cities (March, 1982); Gas Research Institute, Cogeneration Energy Systems Assessment (January, 1982); and OTA, Industrial and Commercial Cogeneration (March, 1983).

Coalition Supports the Role of Tax Incentives for New Energy Technologies

The membership of the Coalition supports the role of tax incentives for new energy technologies. Specifically, H.R.3072 and S.1305 provide an extension of necessary business energy tax credits for various renewable energy technologies, extend the affirmative commitments provisions for certain energy property, clarify treatment of certain energy property installed as a "structural component" of a facility, and reinstate the cogeneration tax credit which expired on December 31, 1982. Many renewable energy projects may also consider the deployment of cogeneration technology, particularly for biomass and synthetic fuels plants, and the certainty and relief provided by such legislation would be welcomed at a minimal cost to the American taxpayer through reduced Treasury revenues. This critical review by the Subcommittee of the availability of energy tax credits and their role in developing and commercializing energy technology is timely as many renewable energy and cogeneration projects enter critical decision-making on ultimate development and construction during the remainder of this decade. Larger-scale energy projects may also require significant lead times with substantial front-end capital requirements which the availability of energy tax credits and some measure of tax stability can offer a significant contribution.

Because of the unique circumstances regarding cogeneration--which specific energy tax credit was permitted to expire on December 31, 1982--the Coalition believes that a broader, more comprehensive approach embodied in H.R.3072 merits close Congressional review and scrutiny as introduced by the Committee Chairman with Representative Cecil Heftel and twenty co-sponsors. A companion bill has been introduced in the Senate as S.1305 by Senators Bob Packwood and Spark Matsunaga with ten co-sponsors. This legislation would operate to reinstate the cogeneration tax credit as well as generally extend the duration of renewable energy tax credits, remove the oil and gas limitation for the cogeneration tax credit, and selectively increase the amount of those tax credits for certain technologies. In this regard, the Coalition believes the level of the cogeneration tax credit contained in this legislation is appropriate, as well as its termination date which would extend such tax credits to 1990.

With the expiration of the cogeneration tax credit on December 31, 1982, a distinct market response ensued as development activities flattened during the first half of 1983. Financial institutions in many instances increased their discount rates for such projects and internal corporate hurdle rates increased as well. With the introduction of these bills and with several other developments, market interest has renewed within the past two months. In order to maintain this momentum, it is essential that action on renewal of the cogeneration tax credit occur this year to maintain continuity and current development patterns. Further delay until 1984 will only operate to create further difficulties in private financing of these projects.

Since most of this financing will occur through third parties, the role of tax incentives and the necessity for stability in tax planning become paramount at this time.[4]

Importance of Energy Tax Credits as Financing Tools

A more comprehensive energy tax credit plan is a critical element of a national energy policy. In order to finance any cogeneration project, a financial institution will consider in its analysis eight specific risk factors with the project:

1. Technical Risk

   - Will the project use a proven or a new technology? The lender obviously prefers to see proven technology in a project under review for private financing.

2. Market Risk

   - What is the likelihood that the project will have an assured market for the output at prices that return a profit when the project is completed?

   - What is the nature of the contracts which govern the sale of the electricity and steam? How firm and how long are the contracts?

3. Economic Risk

   - What is the likelihood that the economic projections which forecast amount of production, sales prices, operating costs and earnings generated over the life of a project will be maintained over time?

   - What is the degree of latitude or sensitivity among various project assumptions?

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[4] We also note the recognition of the role of third party financing in government facilities in recent comments by Representative Ottinger, a member of this Committee. In recent correspondence with the General Accounting Office, he has sought a study of the concept of shared-savings financing for federal buildings and he pinpoints potential impediments and barriers which would impede broader use of such third party financing and contracts in federal buildings. Such constructive approaches are desirable, and further study of this issue is also expected by the Department of Housing and Urban Development later this year.

4. Financial Risk

   - Will the project be able to generate sufficient earnings to service the debt and to return invested capital to the project sponsors? Minimum annual coverage of 1.5 cash flow to debt service is typically preferred by lenders.

   - What is the percentage of equity invested in the project? Is the amount sufficient to provide a cushion for unexpected contingencies?

5. Supply Risk

   - What is the likelihood that the project managers can obtain a reliable and steady supply of feedstock necessary to ensure the efficient and economical operation of the cogeneration facility?

   - What are the terms of the supply contracts regarding duration, pricing and interruptibility?

6. Completion Risk

   - What is the likelihood that the project can be completed without excessive delays and will operate according to minimal standards of performance?

   - Have feasibility studies been performed?

   - What is the reputation of the design engineers, project managers and contractors who have been retained to develop and complete the project?

7. Regulatory Risk

   - Has the project satisfied all environmental and regulatory requirements for siting, construction and operation?

   - What is the likelihood that changing legislation, regulations, or judicial challenges could impair the performance of the project?

8. Operating Risk

   - Once the plant is operating, will the lender be assured that the project will be managed and operated by experienced, trained personnel?

- In addition, is all necessary insurance for operation of the project in place?

The risk involved in an assessment of each of these factors must be evaluated on its own, and also in relationship to the other risk factors, in order to determine the overall risk of the project. A project sponsor wants to structure a project which minimizes his credit exposure. A lender, on the other hand, wants to be assured that the project has support available to it to provide for debt repayment. Project financing negotiations will attempt to balance these opposing objectives.

The extent to which these relative risks are perceived is a function of the quality and maturity of these technologies and principles of economics. Cogeneration has enjoyed successful experience. It currently supplies approximately 5% of total U.S. electricity production, and this relative contribution could double by 1990. Yet, many cogeneration projects are perceived by investors and financial institutions as risky requiring a rate of return which can exceed the return available on more conventional investment opportunities. These rates of return range from 25% to 30% currently, while for comparative purposes, the current returns of the Fortune 1000 companies range from 12% to 15%.

Energy Policy, Revenue and Financial Benefits of Tax Incentives

Moreover, the energy marketplace in this country is not a free market for the provision of electricity, natural gas and other fuels. Favorable tax treatment exists in the form of expensing costs of extraction and depletion allowances, while business use of various fuels is an ordinary and necessary business expense deductible in computing federal income taxes. Tax incentives rectify these imbalances in our economic system, address the perceived risks associated with these technologies by offering a premium incentive for investment in such projects, and offset the tax benefits of expensing usage of fuels by business in general.

Moreover, reduced energy costs have the potential to reduce tax deductions in deriving taxable income with positive feedback effects offsetting revenue losses from the tax credits themselves. Further, the increased economic activity associated with the enhancement of energy efficiency through cogeneration generates additional taxable income with further positive feedback effects. The net tax income to the economy assuming a 30% effective tax rate from $20 to $30 billion of cogeneration installation and construction by 1990 could range from $6 to $9 billion far offsetting any projected revenue losses to the U.S. Treasury. This means that for every dollar of energy use saved by the investment, the Treasury in effect recovers increased tax revenues--revenue which would not have been collected but for the energy saving capital expenditure.

Cogeneration projects are financed generally with two types of funds: debt and equity (risk capital). The availability of energy tax credits for equity financing becomes critical for three reasons: first, it is self-implementing; second, it is available on a timely basis when the cogeneration system is placed in service, and is valued at close to net present value unlike depreciation allowances; and third, its value to the taxpayer unlike depreciation allowances is constant, and is not contingent upon the marginal tax rate of the particular investor.

The impact of energy tax credits for such technologies as cogeneration proved an important tool in arranging financing for projects, and helped in stimulating capabilities to attract risk capital to these projects. However, the full value of such provisions as an incentive and Congressional intent in support of such technologies has been thwarted by:

1) failure of the Internal Revenue Service to properly interpret or meaningfully implement such provisions;
2) continued attacks by this Administration against the energy tax credits even when they were in existence;
3) imposition of expiration dates coupled with restrictive IRS interpretations on affirmative commitments which precluded inclusion of the credits in the investment decision-making process in any meaningful manner;
4) potential shifts in Treasury/IRS policies regarding the tax credits and also restrictive treatment of accelerated depreciation for cogeneration projects as either public utility property, or where such property is installed in tax-exempt or municipal entities.

With so many unknown and uncertain variables, it is no surprise that underlying challenges regarding the effectiveness of such energy tax credits as a business investment tool have become really self-fulfilling prophecies and somewhat misguided in analyzing and determining the ultimate effectiveness of such tax incentives in business planning and decision-making.5/

Treatment of Oil and Gas Use for Cogeneration

Finally, S.1305, but not H.R.3072, would also remove the limitation on availability of the cogeneration tax credit with respect to oil and natural gas use which merits special commentary. Under this limitation, the annual use of oil or natural gas fuel in the cogeneration system must be less than 20% of all fuel used each year and must be limited to use as a

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5/ Constant shifts in tax policy have also affected planning for such projects. See Attachments 4 and 5 regarding changes in the recent tax legislation in 1981 and 1982 affecting cogeneration development.

startup, backup or flame stabilization fuel under the old requirements of Section 48(l)(14) of the Internal Revenue Code which expired last year.

The Coalition supports removal of this unnecessary restriction. Omitting oil and gas or any of their products as primary fuels for purposes of the cogeneration tax credit is counterproductive since the most effective and currently available cogeneration technologies are gas-fired. S.1305's treatment of this issue in Section 5 of the bill clearly recognizes that only large-sized cogeneration facilities possess the economies of scale and capital requirements to utilize coal. The only reasonable and available fuel choice in the interim is oil and gas for small and medium-sized cogeneration facilities, and particularly for the commercial market for schools, hospitals, universities and multi-family residential applications. Use of oil and gas in a cogeneration facility is not inconsistent with national energy policy objectives since it offers increased efficiencies in use of these fuel inputs over use of such fuels in separate facilities. Also, the use of oil and gas in the interim can provide an important bridge or transition to synthetic fuels derived from wood, biomass or lignite for the long-term use in cogeneration applications. Finally, analysis conducted by one of the Coalition's members indicates that removal of this limitation would lead to increased cogeneration equipment purchases of $2 billion over the next four years creating an additional 10,000 jobs in the depressed equipment manufacturing industry alone.

Thus, removal of this type of restriction represents sound tax and energy policy for several other reasons:

1. Such fuel restrictions for the cogeneration tax credit would be discriminatory and administratively unfeasible to implement over the long-term.

2. Such restrictions would be inconsistent with the holding in the American Electric Power case regarding the undesirability of using fuel restrictions to impede cogeneration development.

3. Such limitations are contrary to current exemptions and size limitations already enacted in the Fuel Use Act and implemented by regulation by DOE.

4. Consideration of such proposals is inconsistent with current Administration and Congressional efforts to repeal the Fuel Use Act in its broader consideration of natural gas legislation.

5. Such a provision could place gas-fired cogeneration at a competitive disadvantage with electric utility baseload generation using natural gas which is encouraged as a matter of national policy under FERC Order No. 30, the prior temporary public interest

exemptions under FUA, and the relaxation of the off-gas ban in 1981 under FUA.

6. Environmental and efficiency benefits associated with gas-fired cogeneration would be lost.

7. Energy tax legislation is not the appropriate context to be addressing the fuel use issues raised. Instead, such concerns should be articulated in the context of reconsideration of the Fuel Use Act or the Clean Air Act.

8. Associated environmental and state and local tax-related concerns which are woven into the fuel use argument are more appropriate and germane for consideration at the state level, and not as a matter of federal statute.

Use of Leasing by Tax-Exempt Institutions and Government Entities

Congress is also considering legislation which could have negative implications for cogeneration and renewable energy development where leasing is involved by tax-exempt institutions and government entities (H.R. 3110; S.1564). In general, these bills are intended to significantly reduce the tax incentives associated with property used by these entities which are exempt from Federal income taxes. This would be accomplished by generally lengthening the period over which the owner property used by a tax-exempt entity may claim cost recovery deductions with respect to the property and by tightening the criteria that are used in distinguishing a lease from a service agreement. In effect, to address certain unique situations which have arisen, Congress may foreclose an important financing tool for cogeneration and renewable energy in these tax-exempt institutional applications. The Administration has taken this a step further by recently recommending before the House Ways and Means Committee that a rule should be considered whereby any project whose entire output is sold to a governmental or a tax-exempt organization would be treated as a lease to that purchaser. If this rule is adopted, it would result in the complete loss of energy and investment tax credits for such projects. Further, if this rule were used to characterize power sales contracts as leases for other purposes of the investment and energy tax credits, it could preclude individual investors from participating in such energy projects, even if the electricity were sold to a taxpaying purchaser.

The Cogeneration Coalition, as part of a larger group effort within the energy industry, endorses efforts to curb tax abuses arising out of such leasing arrangements. However, certain provisions in the bill demand reconsideration, and we urge this Committee to assume a leadership role in expeditiously making constructive recommendations on these issues to the House Ways and Means Committee.

As stated in joint comments filed last month by the Coalition with the National Hydropower Association, tax-exempt organizations and governmental organizations are substantial consumers of electrical and thermal energy. As such, they are well suited to take advantage of the energy alternatives presented by cogeneration systems. Potential customers for the output of such systems range from hospitals, prisons and government buildings which can use the thermal energy produced by cogeneration systems, to municipal electric utilities and rural electric cooperatives which can use the electricity produced by cogenerators or other renewable technologies.

Currently, property leased to a governmental unit or tax-exempt organization is ineligible for the investment and energy tax credits. Moreover, the IRS has long taken the position that service contracts which more closely resemble leases than actual service contracts in substance should be classified as leases for purposes of this rule. However, both the IRS and the courts have also recognized that property used to provide a service to a governmental unit or a tax-exempt organization under a legitimate service contract should remain eligible for the tax credits. This distinction is based on sound public and tax policy considerations. There is no reason why legitimate, taxpaying, service-related business should be treated differently merely because their customers are tax-exempt, as opposed to taxable entities. The IRS has applied a variety of criteria, including control over use of the property, right to possession of the property, and risk of loss with respect to the property, in distinguishing service contracts from leases. These criteria have proven enforceable, and have provided stability for tax planning where leasing will be employed.

One section of these bills before the Congress would amend the Internal Revenue Code to specify that a contract which purports to be a service contract, but which more closely resembles a lease, will be treated as a lease for purposes of determining eligibility for the tax credits. This provision indicates that the determination of whether a lease more closely resembles a service contract should be based on all of the facts and circumstances, including whether the user has control over the property and whether the user has a significant possessory or economic interest in the property.

This proposal has generated considerable confusion and uncertainty within the cogeneration and renewable energy industries. In particular, energy project developers have been unable to determine whether this version is intended to give Congressional approval to the existing criteria, or is intended to alter those criteria in a manner which would make it more difficult for a contractual arrangement between a private energy supplier and a governmental entity or tax-exempt organization to be classified as a service contract for tax purposes. This has had a substantial chilling effect on projects whose output will be sold to governmental units or tax-exempt organizations.

The Coalition urges that any legislation on this issue should clearly reaffirm, and not alter, the criteria applied under current law to distinguish service contracts from leases.

These criteria provide the IRS with adequate means to distinguish legitimate service contracts from leases. At the same time, they have created a set of standards which allow cogeneration project developers to enter into contractual arrangements with tax-exempt organizations and governmental units with reasonable certainty as to their classification for tax purposes. Any change in these criteria could make it much more difficult for cogeneration project developers to work with tax-exempt or governmental entities. Because that could cost the country the benefit of the substantial energy savings and efficiency improvements which could be realized from the governmental and tax-exempt sectors, it would be an unfortunate result not only for the cogeneration industry, but for the entire country.

Conclusion

For these reasons, the membership of the Cogeneration Coalition, Inc. strongly urges this Committee to consider and recommend a comprehensive and more substantial approach in its deliberations and review of energy tax credits and to proceed on an expeditious basis to preserve continuity for cogeneration development on such issues as leasing by tax-exempt institutions. Only this course will offer a more meaningful, permanent response benefiting these important technologies for long-term planning through this decade to satisfy the electric power supply challenges which our nation is rapidly facing.

We appreciate the opportunity to appear before this Subcommittee, and will be pleased to answer any questions you may have.

- Attachment 1 -

SIC	Potential NW (MW)	(%)	Potential Number of Plants Number	(%)
20	7,146	17	863	27
26	8,414	20	454	14
28	9.800	23	408	13
29	10.976	26	179	6
33	2,823	6	307	10
Remaining Sector	3.665	8	920	30
	42.824		3,131	

Size (MW)	Total MW Production	(%)
< 2	847	2
2-10	6.073	14
10-50	12,433	29
50-100	7.417	17
> 100	16,054	37
	42.824	

SIC Definition

SIC	Definition
20	Food
21	Tobacco Products
22	Textile Mill Products
23	Apparel
24	Lumber and Wood Products
25	Furniture and Fixtures
26	Paper
27	Printing and Publications
28	Chemicals
29	Petroleum and Coal Products
30	Rubber and Misc. Plastic Products
31	Leather
32	Stone, Clay and Glass Products
33	Primary Metals
34	Fabricated Metal Products
35	Machinery, Except Electrical
36	Electric and Electronic Equipment
37	Transportation Equipment
38	Instruments and Related Products
39	Miscellaneous Manufacturing

- Attachment 2 -

*Regional Summary of Potential Cogeneration**

Region	*Number of Potential Plants*	*Potential Power Generation* (MW)	*Potential Electricity Generation* (10^6 Kwh)	*Potential Steam Generation* (10^6 1b/yr)	*Potential Energy Savings* (10^9 Btu/Yr)
New England	289	3.014	17,464	98.843	115.386
NY/NJ	265	2.833	19.070	116.035	128.872
Mid-Atlantic	319	4,536	30,183	215.531	206 834
South Atlantic	544	5,757	40,464	396,778	294.648
Mid West	559	5,226	37,874	321.993	251.377
South West	335	11,362	91,714	763.314	631 891
Central	186	2,411	17,895	153,122	119.403
North Central	38	506	4.072	33.817	27 684
West	408	7,708	43.219	216,761	278.744
North West	150	1,316	8.642	64.474	58.830
TOTALS	3.093	44.669	310.593	2.380.634	2.113.620

*Best System At Plant Site Accelerated Depreciation ROI > 7%

- Attachment 3 -

*State Summary of Potential Cogeneration**

State	*Number of Potential Plants*	*Potential Power Generation* (MW)	*Potential Electric Generation* (10^6 Kwh/Yr)	*Potential Steam Generation* (10^6 1b/Yr)	*Potential Energy Savings* (10^9 Btu Yr)
Alabama	98	1.658	11.669	164 638	91 623
Alaska	3	2	12	449	121
Arizona	24	110	724	11,852	6.184
Arkansas	39	1.120	6.934	83.557	53.461
California	382	8,537	49,732	239,307	318,376
Colorado	17	235	1,781	9.897	11 321
Connecticut	47	370	2,416	12.470	16.154
Delaware	15	426	3,538	16.695	22.835
Dist. of Col.	0	0	0	0	0
Florida	77	1,917	11,978	116.212	98 235
Georgia	113	1,318	9.557	162.086	81 804
Hawaii	15	252	990	6.060	6.557
Idaho	20	430	2,953	10,776	18.424
Illinois	181	2,452	18.792	133.201	111.819
Indiana	61	1,595	13.011	104.173	75.784
Iowa	51	451	2.912	38.936	23.256
Kansas	29	976	8.007	43.220	50.358
Kentucky	41	638	4.934	51.514	30.882
Louisiana	94	6,202	52,148	433.444	352.404
Maine	63	1,678	12.098	77.380	81.028
Maryland	18	274	2.079	19.871	12.138
Massachusetts	134	1,168	6.327	27.875	39.609
Michigan	121	1,345	9.970	112.089	70.283
Minnesota	42	456	3.095	34.342	20.571
Mississippi	51	1.580	12.315	73.164	82.800
Missouri	53	506	3.530	29.428	24.752
Montana	10	211	1.545	8.739	9.799
Nebraska	20	85	452	7.457	3.777
Nevada	2	2	6	85	49
New Hampshire	26	296	1.658	11.897	11.387
New Jersey	125	2.323	16.515	83.110	108.368
New Mexico	20	119	656	10.511	5.533
New York	156	1.304	8.297	66.229	58.460
North Carolina	121	1,030	7.397	91.106	57.427
North Dakota	1	1	3	46	23
Ohio	156	2.280	16.043	126.894	108.236
Oklahoma	28	668	5.119	54.366	37 366
Oregon	81	647	4.333	46.987	32 719
Pennsylvania	214	4,172	28.637	169.685	183.333
Rhode Island	24	280	1.358	4.894	7 715
South Carolina	82	757	5.718	85.074	46.918
South Dakota	3	2	5	94	45
Tennessee	47	1.694	14.051	63.356	89.938
Texas	186	5.878	48.502	603.618	352.682
Utah	7	145	1.261	10.210	8.342
Vermont	13	103	500	2.680	3.360
Virginia	82	1.359	7,733	103.885	61 612
Washington	51	813	5.483	37.472	36.240
West Virginia	19	361	2.970	42.059	21.162
Wisconsin	72	642	4.348	64 644	36.115
Wyoming	6	95	796	13.816	6 872
TOTALS	3.093	44.669	310.593	2.380.634	2.113.620

*Best System at Plant Site Accelerated Depreciation ROI > 7%

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September 24, 1981

Impact of the Economic Recovery Tax Act of 1981 On Cogeneration Development

Background

After extensive debate since early 1981, the Congress passed on August 4, 1981 the conference report on the Economic Recovery Tax Act of 1981, H.R. 4242, H. Report. No. 97-215 (1981), S. Rept. No. 97-176 (1981). The bill was signed into public law on August 13, 1981, Publ. L. No. 97-34, and contains several provisions having important bearing on cogeneration development.

The following is a brief summary of those provisions bearing on cogeneration development in the Act. Subsequent technical corrections and regulations will be necessary to clarify both the intent of Congress and specific provisions of the new law. More detailed advise regarding the applicability of these provisions to specific cogeneration projects should be sought from legal counsel.

Summary

The major provisions affecting cogeneration development are:

- An Accelerated Cost Recovery System (ACRS) has been created to replace depreciation deductions under the Asset Depreciation Range (ADR) system. The new system is effective for property placed in service after December 31, 1980. Property is placed into classes of 3, 5, 10 and 15 years with capital costs for acquisition recovered over these periods.

- The regular investment credit is available for 3 year property at a rate of 6%, and for 5, 10, and 15 year property at a rate of 10%. The carryover period for unused investment tax credits has been extended from 7 to 15 years.

- A 25% investment tax credit for research and experimentation expenditures has been created. This tax credit is available to the extent that current year expenditures exceed the average amount of research expenditures in a base period (generally, the preceding three taxable years). The tax credit applies to research expenditures made after June 30, 1981 and before 1986.

- The allowance of investment tax credits is subject to an at-risk limitation. Thus, the investment tax credit is not allowed with respect to amounts involved in qualifying property to the extent the invested amounts are not at risk within the meaning of Section 465(b) of the Code (without regard to Section 465(b)(5)). However, an exception is provided for certain types of loans and a safe harbor rule has been provided for certain loans related to energy property including cogeneration projects.
- New leasing provisions under the Act make equipment leasing very attractive where the taxpayer has the inability to use tax credits and deductions for such expenditures because he lacks sufficient taxable income. Thus, the Act guarantees that such leasing transactions will be characterized as a lease for purposes of allowing investment tax credits and cost recovery allowances to the nominal lessor.

Accelerated Cost Recovery System

Under prior law, depreciation deductions were allocated over the period the asset was used in business based upon an estimation of the asset's useful life under the ADR system. Thus, deductions for the cost of an asset were closely matched with the income produced by that asset.

The new system basically establishes five classes of assets with separate recovery periods that are shorter than the useful life of the asset, or the period over which the asset produces income. Table 1 illustrates the new classifications under the Act:

Table 1

3 years	Autos, light-duty trucks, R&D equipment and personal property with an ADR midpoint life of 4 years or less.
5 years	Most other equipment except long-lived public utility property. Also includes single purpose agricultural structures and petroleum storage facilities, which are designated as Section 1245 property under the Act. Generally, cogeneration equipment falls within this category.
10 years	Public utility property with an ADR midpoint life greater than 18 but not

	greater than 25 years; railroad tank cars; and real property with an ADR midpoint life of 12.5 years or less. Also includes public utility coal-fired conversion (including dual-fuel) boilers and burners.
15 years	Public utility property with an ADR midpoint life in excess of 25 years.
15 years	Real property with an ADR midpoint life in excess of 12.5 years.

In addition to creating substantially shorter recovery periods for business property, the ACRS system provides some flexibility to taxpayers for business planning purposes. The taxpayer may use the ACRS method over the recovery period designated by the class in which the property is categorized, _e.g._, 10 years for 10-year property. The taxpayer may also elect to use a straightline method over this period. With respect to recovery periods, the taxpayer may elect to use a period which is longer than that designated by the class of property. If he elects a longer period, the taxpayer must use a straightline method of depreciation.

Through these alternative recovery periods and methods, a business taxpayer may engage in a certain amount of tax planning to afford himself a better cash flow by matching deductions with projected future income and earnings. The optional recovery periods allowable for property in each of the five classes is set forth in Table 2:

Table 2

Property:	The taxpayer may elect a recovery period of:
3-year property:	3, 5 and 12 years
5-year property:	5, 12 and 25 years
10-year property:	10, 25 and 35 years
15-year property:	15, 35 and 45 years

From 1981 to 1984, the recovery allowance in each of the asset categories is calculated by use of 150% of the declining balance method of depreciation. In 1985, the calculation increases to 175% of the declining balance method and to 200% after 1985. Thus, the phasing of the prescribed accelerated method for property placed in service may yield longer term impacts on equipment acquisition over the next five year period. The impact of the new tax system on shortening depreciation lives is illustrated in Table 3:

Table 3

Investment	Old	New	Percentage Reduction in Writeoff
Office Buildings	41	15	63%
Oil Refining and Distribution Equipment	13	5	61%
Factories	37	15	59%
Retail Stores, Shopping Centers	36	15	58%
Metals Manufacturing Plant and Equipment[a]	12.7	5.7	55%
Apartment Buildings	32	15	53%
Office Furniture and Fixtures	8	5	37%
Chemical Manufacturing Plant and Equipment[a]	9	5.7	37%
Electric Machinery Manufacturing Plant and Equipment[a]	8	5.8	27%
Land Improvements, Roads, Docks	20	15	25%
Motor Vehicle Manufacturing Equipment	6	5	20%
Autos and Light Trucks	3	3	-
Information and Data System	5	5	-

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[a] Composite based upon estimates.

Availability of Investment Tax Credit

The regular investment tax credit applies to tangible personal property and other tangible property used in connection with manufacturing, production, or certain other activities not involving distribution. The Act adds to eligible property facilities used for storage of petroleum and its primary products, even if used in connection with distribution.

Under prior law, the amount of investment credit was determined on the basis of the estimated useful life of the property. Therefore, if the estimated useful life was less than 3 years, the property received no credit; if 3-4 years, 3 1/3% tax credit; if 5-6 years, 6 2/3% tax credit; and if 7 or more years, 10% tax credit.

Under the Act, the amount of investment credit for 3 year property is a tax credit of 6%; the amount for 5, 10 and 15 year property is a tax credit of 10%.

Recapture of the tax credit for early disposition is based on 2% credit for each year the property is held. Therefore, no recapture is required for eligible 5, 10 or 15 year property actually held for at least 5 years, or for eligible 3 year property held for at least 3 years.

Finally, under prior law, unused investment tax credits could be carried back 3 years and forward 7 years. The Act extends the carryover period to 15 years creating better possibilities for using available investment credits.

Research and Experimentation Tax Credit

Under present law, a taxpayer could elect to deduct currently the amount of research or experimental expenditures incurred in connection with the taxpayer's trade or business, or could elect to amortize certain research costs over 60 months or more under Section 174 of the Code.

The Act provides a new 25% tax credit for certain research and experimentation expenditures made after June 30, 1981 and before 1986. The tax credit is available to the extent that current year expenditures exceed the average amount of research expenditures in a base period (generally, the three preceding taxable years).

Research expenditures qualifying for the new tax credit include:

1) in-house expenditures for research wages and supplies, and certain lease or other charges for research use of computers, laboratory equipment

2) 65% of the amounts paid to a research firm or university for contract research services

3) 65% of corporate grants for basic research to be performed by universities or certain scientific research organizations.

Under these provisions, a limited partnership could be established to finance corporate research and development and take R & D tax deductions and credits while sharing in the revenues, if any, of the products ultimately developed and sold. Any returns to investors would likely be taxed at no more than the 20% maximum capital gains rate under the Act. Further, 85% to 90% of their outlays could be deductible from individual taxable income as high as 70% under current law, and 50% when the new Act is is full effect.

At-Risk Limitations

Under prior law, there was no at-risk limitation on the allowance of investment tax credits. Under, the new Act the allowance of investment credits is subject to an at-risk limitation.

However, an exception from this limitation is provided for certain direct or guaranteed governmental loans and certain amounts borrowed from banks, saving and loan institutions, credit unions or insurance companies. These amounts owed to qualified lenders are considered at risk even if the taxpayer is not personally required to repay the debt. The qualified lender exception also includes a safe harbor rule for certain loans related to energy property. Cogeneration equipment is included in that special rule and is defined as property comprising a system for using the same energy source for the sequential generation of electrical power, mechanical shaft power, or both, in combination with steam, heat, or other forms of useful energy. To qualify under this rule, the taxpayer must have at risk an investment that is at least 25% of the unadjusted basis of the property (determined without regard to any safe harbor rules). Also, any nonrecourse financing for the property (other than financing from a qualified lender considered at risk) must be in the form of a level payment loan.

Leasing Provisions

Under prior law, a transaction was characterized as a lease if:

1) the lessor's minimum at risk investment in the property throughout the lease term was 20% of cost

2) the lessor had a positive cash flow and a profit from the lease independent of tax benefits

3) the lessee had no right to purchase the property at less than fair market value

4) the lessee did not have an investment in the lease and did not lend any of the purchase costs to the owner, and

5) use of the property at the end of the lease term by a person other than the lessee must be commercially feasible.

The Act creates special rules whereby a transaction will be characterized as a lease for purposes of allowing investment credits and cost recovery allowances to the lessor. Some of the key requirements to qualify are:

1) Both the lessor and lessee must affirmatively elect to treat the lessor as the property owner.

2) The lessor must be a corporation, a partnership of corporations, or a grantor trust (where grantor and beneficiaries are corporations).

3) At all times during the lease term and when the lease is placed in service, the lessor must have a minimum of 10% of the adjusted basis of the property at risk.

4) The lease term cannot exceed the greater of 90% of the useful life of the property under Section 167 or 150% of the present class life based upon the ADR midpoint as of January 1, 1981.

5) The property must be new Section 38 property or certain qualified mass transit commuting vehicles.

6) The leased property must be leased within 3 months after its acquisition, or if a sale leaseback transaction, it must be purchased by the lessor within 3 months of the lessee's acquisition for a purchase price under special rules.

The new requirements operate to loosen prior restrictions on what constitutes a lease, on the financing of such equipment, and on the profit to the company arranging the lease. Also, the Act makes it cheaper for the company using the equipment to buy it when the lease expires. The new changes could lead to tax savings through these transactions of $9.6 billion by 1986.

For example, a company with an operating loss could purchase $1 million of equipment generating a $100,000 investment tax credit which it can't use because of no current tax liability. A profitable company interested in tax deductions and tax credits could agree to lease the equipment to the loss company. The profitable company could make the minimum investment of $100,000 (reflecting 10% at risk), and give the loss company a five year note for the remaining balance of $900,000. The profitable company could immediately use the $100,000 investment tax credit and the depreciation deductions on the purchased equipment to further reduce taxes.

The lease could be established for a term of five years and the payments with interest could match the payments on the note for the remaining balance of the equipment price. Therefore, no money would need to exchange hands. The loss company would have responsibility for insurance, maintenance and taxes and could purchase the equipment back at the end of the lease term.

Under this example, the profitable company exchanges $100,000 for a $100,000 investment tax credit, $46,000 in first year depreciation allowances, and the interest deductions on the five year note. These depreciation and interest deductions extend over the life of the lease. The loss company receives financing for $1 million of equipment that actually cost $900,000.

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November 30, 1982

Impact of the Tax Equity and Fiscal Responsibility Act of 1982 on Cogeneration Development

Background

After extensive discussion in 1982, the Congress passed on August 19, 1982 the conference report on the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA), H.R. 4961 (H. Rept. No. 97-760 (1982). The bill was signed into public law on September 3, 1982, and contains several provisions having important bearing on cogeneration development.

The following is a brief summary of those provisions bearing on cogeneration development in the Act. Subsequent technical corrections and regulations will be necessary to clarify both the intent of Congress and specific provisions of the new law. More detailed advice regarding the applicability of these provisions to specific cogeneration projects should be sought from legal counsel.

Summary

The major provisions of the Act affecting cogeneration project development are:

- There is a new basis adjustment for business investment and energy tax credits. Under the new law, the taxpayer must reduce, for ACRS purposes, the basis of assets by one-half the value of Section 38 tax credits.
- The investment credit limitation will be reduced from 90 percent to 85 percent of tax liability beginning in 1983. But unused credits for 1983 can be carried back for three years (1980-82) and carried forward for fifteen years (1984-98).
- The provisions for higher ACRS writeoffs for 1985 and 1986 have been revoked, thus the writeoff percentages for 1981 through 1984 will continue in effect for post-1984 years.

- Beginning in 1983, corporations will be required to capitalize interest and property taxes attributable to the construction of non-residential real property.

- A new category of tax leases is established referred to as "finance leases", and they will go into effect after 1983. As with safe-harbor leases, lease treatment is specifically guaranteed for finance leases provided certain prerequisites are met.

- One of the major changes effected by TEFRA is that public utility property will no longer be eligible for safe-harbor lease consideration, except in limited instances under certain transition rules. In addition, safe-harbor lease provisions for leases entered into after December 31, 1983 have been repealed.

- Restrictions were placed upon tax benefit transfer (TBT) leases under the safe-harbor leasing rules adopted in 1981. As of July 1, 1982, lessees can only apply the safe-harbor rules to no more than 45 percent of their qualified base property placed in service during the calendar year.

- A number of restrictions were added on the use of tax-exempt Industrial Development Bonds (IDBs) for private activities. However, the interest exemption for IDBs was expanded to include uses associated with "local district heating and cooling facilities."

Investment Credit Basis Adjustment

The new law stipulates that the taxpayer must reduce, for Accelerated Cost Recovery System (ACRS) purposes, the basis of eligible property by one-half of the amount of regular and energy credits and the credit for rehabilitation expenditures for certified historic structures. For example, for property eligible for a 10 percent energy credit, only 95 percent of the asset's value could be depreciated. This same reduction in basis is also required for credits claimed for qualified progress expenditures.

As an alternative to this 50 percent reduction, the business may opt to take the full depreciation allowance provided it reduces its investment credit by 2 percent. This only applies to the investment credit and not to the energy or rehabilitation credits.

Other points:

(1) In figuring the amount of ordinary income for recapture purposes, the amount of the basis reduction is treated as a recovery writeoff

and may be recaptured. However, if the disposition triggers recapture of the credit, there will be an upward adjustment of basis immediately prior to the disposition of half the amount of the recaptured credit.

(2) The basis adjustment will not be taken into account in figuring earnings and profits. Consequently, U.S. corporations must use the straight-line recovery method over recovery periods that are longer than those used to compute deductions under ACRS for income tax purposes.

When lessors elect to pass the investment credit through to the lessees, no basis adjustment is required by the lessor. Rather, the lessee includes in income one-half the credit ratably over the ACRS recovery period. If the lessee elects to claim a reduced credit, no additional income need be recognized.

These rules apply to property placed in service after December 31, 1982, other than property (which is not public utility property, property subject to a safe-harbor lease or a rehabilitated building) placed in service before July 1, 1984, for which a contract was entered into after August 13, 1981, and was binding on July 1, 1982, and at all times thereafter.

Investment Credit Limitation

Beginning in 1983, investment credit will be limited to 85 percent of tax liability rather than the present 90 percent. If any credit is unused due to the limit on tax, it can be carried back for 3 years and carried over for 15 years in much the same way as a net operating loss is handled. For example, unused credits for 1983 can be carried back to 1980-82 and over to 1984-98. If in this timeframe the tax credit is not used up, it can be used as a deduction.

ACRS Changes

Congress repealed the provisions that would have accelerated cost recovery rates for 1985 and 1986. Therefore, the writeoffs for 1981 through 1984 will remain in effect after 1984.

For example, the following represents a summary of the ACRS writeoff percentages for 3-year and 5-year property placed in service in 1981-84:

Recovery Period	Percentage
3-Year Property	
1st year	25%
2nd year	38%
3rd year	37%
5-Year Property	
1st year	15%
2nd year	22%
3rd year	21%

Capitalization of Construction Period Interest & Taxes

Beginning in 1983, corporations will be required to capitalize interest and property taxes attributable to the construction of non-residential real property. Amortization of these capitalized amounts is generally over a ten-year period. This construction period begins the date on which construction of the building or other improvements begins, and ends of the date on which the property is ready to be placed in service or is ready to be held for sale.

These new rules do not apply to buildings constructed as part of an integrated facility provided construction of one of the units began prior to 1983. An integrated facility is a multi-property facility constructed as a single project or a single project on a single site and operated as a single, unitary facility as described by a written plan evidenced by such purchasing and financing documents. Property is an integral part of an integrated facility if the property:

(1) is described as part of the same project in written plans of the taxpayer in existence on July 1, 1982;
(2) is an integral part of the planned operation of the project when the project will first be placed in service; and
(3) will be constructed during the same construction period as the rest of the project.

Non-Safe Harbor Leasing Rules

The Act established a new category of leases referred to as "finance leases." As with safe-harbor leases, lease treatment is specifically guaranteed for finance leases assuming all of the prerequisites are met. A "finance lease" is defined as an agreement characterized by the parties as a lease with respect to eligible property that would meet the requirements set forth for lease treatment under the old non-safe-harbor rules (Rev. Proc. 75-21), except for the fact that the agreement contains a 10-percent fixed price purchase option or that the property was limited use property. To be characterized as a finance lease, the lessor must be a corporation, a partnership all the partners of which are corporations, or a grantor trust with respect to which the grantor and all beneficiaries are corporations. Only recovery property that is new Section 38 property (eligible for the investment credit) qualifies. For these purposes, TEFRA adopts the special "90-day window" identical to that provided for safe-harbor leases in the Economic Recovery Tax Act of 1981. Consequently, property subject to a non-safe-harbor lease will still be considered new property eligible for this special treatment if it is leased within 90 days after the property is placed in service. Public utility property, however, is specifically excluded from eligibility.

The 10-percent fixed price purchase option that is permitted for finance leases is defined to mean an option of the lessee (i.e., a call option) to purchase the property at the end of the lease term for a price that is fixed as of the beginning of the lease term in an amount equal to 10 percent or more of the original cost of the property. The investment credit must be amortized over 5 years rather than claimed in its entirety in the year the property is placed in service. The basis adjustment for half of the full investment credit, however, must be made in the first taxable year. This amortization provision does not apply to property placed in service after September 30, 1985.

Otherwise, finance leases must meet all the other requirements for lease treatment contained in the old law. Consequently, the transaction must have economic substance independent of the tax benefits and the lessor must reasonably expect to derive a profit from the transaction separate from the tax benefits associated with the project. Furthermore, the transaction must not in substance be a financing arrangement or conditional sale in which the lessee has an investment in the property. Specific limitations are also placed upon the lessor and lessee with respect to the maximum decrease in tax liability and percentage of qualified base property, respectively, derived from finance leases.

Safe-Harbor Leasing Rules

Under the new Act, public utility property will no longer be eligible for safe-harbor lease consideration. In addition, a number of technical changes have been made to the safe-harbor lease eligibility requirements. The maximum lease term can not now exceed the recovery period used for ACRS purposes (5, 8 and 15 years) or, if greater, 120 percent of the present ADR class life. ACRS deductions must be spread out over longer periods of time according to specified percentages. These percentages initially reflect a 150-percent declining balance method of depreciation and change to straight-line in later years. A half-year convention is also utilized in the first recovery year. Furthermore, the investment credit must be amortized equally over the first 5 taxable years of the lease. The interest rate on lessee obligations also may not exceed the rate established for overpayments and underpayments of federal tax.

Since originally enacted in 1981, safe-harbor lease transactions have been used almost exclusively for the sale of tax benefits (e.g. investment credit and ACRS deductions) from a "lessee" not able to take advantage of the tax benefits to a "lessor" with substantial tax liability. With regard to these tax benefit transfer (TBT) leases, some restrictions have been made:

(1) Commencing July 1, 1982, lessees may apply the safe-harbor rules to not more than 45 percent of their qualified base property.

(2) Lessors are not permitted to claim deductions or credits allocable to qualified lease property to the extent they reduce the lessor's income tax liability (including any liability under the add-on minimum tax) by more than 50 percent. Excess deductions or credits may be carried forward, but a lessor cannot use tax benefits obtained as a safe-harbor lessor to generate a net operating loss (NOL) or investment tax credit carryback to a prior year.

(3) Restrictions are imposed to prevent safe-harbor lease transactions from being entered into by related parties and, to limit ITC strips (safe-harbor leases in which only the investment credit is passed to the lessor) for transactions entered into before October 20, 1981 (the date on which the Treasury issued its temporary regulations governing safe-harbor leasing provisions).

Furthermore, TEFRA repealed the safe-harbor lease provisions for leases entered into after December 31, 1983. Otherwise, the modifications enacted by this law are generally applicable to leases entered into or property placed in service after July 1, 1982.

There are, however, numerous transitional rules designed to accomodate transactions wherein contracts were signed prior to this date. Furthermore, the transitional rules are to be applied on a property-to-property basis and should be independently examined for potential applicability to specific projects.

Tax Exempt Obligations

The following restrictions have been placed on tax-exempt bonds for private activities:

(1) In order to issue tax-exempt industrial development bonds (IDBs), public hearings must be held and approval by an elected official or legislative body of both the issuing jurisdiction and the jurisdiction wherein the facilities are located must be obtained. In addition, the issuing jurisdiction must file information returns with the Internal Revenue Service identifying the principal users and amounts involved for such bond financings.

(2) Property financed by IDBs that is placed in service after December 31, 1982, will generally be allowed cost recovery deductions at a lower rate than those permitted under the ACRS schedules or any other accelerated cost recovery provisions contained in the Internal Revenue Code. In lieu of ACRS deductions, the cost of property financed with IDBs may be recovered using the straight-line method over the ACRS life for the property involved. This limitation applies to both the first owner of the property and to all subsequent owners while the issue is outstanding.

(3) The Act repeals the small issue exemption ($1 million or less) for obligations issued after December 31, 1986 and, in the meantime, expands the list of expenditures for which the proceeds of such issues may not be used. The Act also limits the average length of the maturity of all industrial development bonds. Under this rule, the weighted average maturity of all obligations of an issue cannot exceed the weighted average estimated economic life of the assets financed with proceeds of the issue by more than 20 percent.

Another amendment clarified the interest exemption for IDBs issued to finance "facilities for the local furnishing of electricity and gas." This exemption is now to apply only to the furnishing of electricity and gas solely within an area comprised of a city and one contiguous county. Added to this list of permitted uses are "local district heating and cooling facilities," defined as equipment and other property used as an integral part of a local hearing and cooling system, but which does not include facilities which produce the hot water, chilled water, or steam, or which are owned for tax purposes by the consumers.

* * *

MICHAEL J. ZIMMER

Mr. Zimmer is a Partner in the Washington, D.C., Los Angeles, California, Vienna, Virginia, and Madison, Wisconsin law firm of Wickwire, Gavin & Gibbs, P.C. He is a *cum laude* graduate of the University of Maryland/Baltimore School of Law receiving his Juris Doctorate degree in 1975 and a *cum laude* graduate of Providence College receiving his Bachelor of Arts degree in Political Science in 1971.

Mr. Zimmer has represented natural gas distribution companies and electric utilities in matters before the Department of Energy, the Federal Energy Regulatory Commission and the Congress, as well as in selective state proceedings. He also has represented industrial and manufacturing companies, trade associations, universities and embassies on selective issues related to energy conservation, energy taxes, government contracts and mass transit policies. He has also been invited as a witness on various energy and energy tax proposals before Congressional committees and various departments and agencies.

He previously served for three years at the American Gas Association in various legal capacities representing the natural gas transmission and distribution industries, where he left as Staff Vice President, Government Relations ultimately serving in the Association's Senior Management Group. He also has served in various legal capacities with Prentice-Hall, Inc. and the law firm of Pettit, Evers and Martin since his graduation from law school.

He is a member of the bar of the District of Columbia and Virginia and is admitted to practice before the U.S. District Court of the District of Columbia. Mr. Zimmer is a member of the American Bar Association Natural Resources and Public Utility Law Sections, the Federal Energy Bar Association, the International Cogeneration Society and the American Council for Capital Formation.

Mr. Zimmer has made numerous presentations on current energy issues before a wide variety of groups and is a frequent national lecturer on these various topics. He also has served as a guest lecturer at Virginia Polytechnic Institute, University of Wisconsin and Georgetown University. He has authored or co-authored over 40 articles and publications in the fields of energy law, public utility law and business law. He has served as the editor of three publications on the National Energy Act published by the American Gas Association, co-authored *The National Energy Act*, Callaghan Publishing Company (May 1979), *How the Federal Trade Commission Affects Your Business*, Prentice-Hall, Inc. (July 1976), and three editions of *Cogeneration: Current Prospects and Future Opportunities*, Government Institutes, Inc. (February 1982), (October 1982), and (March 1983).

In addition, Mr. Zimmer is a Director of the Cogeneration Coalition, Inc. and is active in local and church affairs in Fairfax County, Virginia.

Mr. FUQUA. Thank you, Mr. Zimmer. We have a vote on and I have got to run over and vote. We will be right back as soon as I can cast this important vote.

[Recess.]

Mr. FUQUA. The committee will resume. I apologize for the delay, Dr. Magerman, we would be pleased to hear from you and Dr. Beale.

Dr. MAGERMAN. I wish to express my appreciation to Chairman Don Fuqua, Democrat-Florida, and to members of the committee for the invitation to testify before the Subcommittee on Energy Development and Applications on the subject of tax incentives for new energy technologies.

Omnimax Inc., is a public company of which I am president and chief executive officer. Our corporate objective is to coordinate new sciences for commercial applications through a network of subsidiaries. We currently have three subsidiaries; one of them is now a public company and the other two are wholly owned by Omnimax. Applied Coatings International is the public company; it is currently involved in the field of polymer coatings. General Molecular Applications is a wholly owned subsidiary advancing research in genetic engineering; and U.S. Energy Resources is another wholly owned subsidiary whose efforts have been directed in research and development in the field of thermoelectric engineering.

Our success, to date, is due to our ability to recognize the tax incentive programs created by Congress. Because we were provided with the existing tax incentives as a tool, we were able to subsidize research in both genetic engineering and polymer coatings; and we are now in the process of financing a prototype thermoelectric generator at U.S. Energy Resources, Inc. Furthermore, we are preparing a 1983 research and development tax incentive program which will focus on the development of new technologies. Programs such as our own serve to stimulate independent research, while, at the same time, minimizing grant requests which inevitably find their way to the doorstep of government.

The quality of our future life in America has always been predicated upon our dedication to research today. The responsibility for that investment into research should not be borne by government alone, but should be shared by the private sector.

Omnimax exemplifies how the private sector and the government can mutually participate in the optimum advancement of research. We at Omnimax coordinate research in new sciences, with commercial applications of these sciences as our goal. The way in which we achieve this end is by forming subsidiary companies, and, most importantly, by utilizing the research and development tax incentive programs made available to us by Congress.

At this point, I am pleased to announce that through research efforts which began at Battelle Memorial Institute and continued at SRI International—formerly Stanford Research Institute—and Georgia Institute of Technology respectively, U.S. Energy Resources has developed a technology that will capture waste heat and convert it into low-cost electricity. This applied technology will lower the utilities' effective cost of production immediately and will afford a tremendous savings to the American public.

Mr. Chairman, I would like to introduce Dr. Harry A. Beale, who is director of research and development at U.S. Energy Resources, Inc. Dr. Beale will provide the committee with a more detailed explanation of our new technology.

However, before Dr. Beale speaks, I would like to thank you and the members of this committee for giving Omnimax the opportunity to testify today; and I can assure this committee that Omnimax will continue to conscientiously apply the economic incentives adopted by Congress for the good of all involved.

Thank you.

Dr. **Beale**. Chairman Fuqua and members of the committee, I appreciate the opportunity to explain to you what we have accomplished at U.S. Energy Resources, Inc. We have applied modern technology to a 150-year-old device and demonstrated the potential for dramatic improvement.

Existing data now indicate the improvement is so great as to be a major breakthrough in increasing energy savings and electrical power production. Briefly stated, our concept involves thermocouple theory.

As shown in the first exhibit, the closest to the rail——

[Chart].

Dr. **Beale** [continuing.] When two different properly selected materials are joined together, a voltage is developed when heat is applied to their junction. This is a fundamental observation and the phenomena is called thermoelectricity. As a matter of routine, thermocouples are presently used only for measuring temperature. When several thermocouples are connected in a regular pattern and when alternate junctions are cooled and a hot region is provided for the in-between junctions, the result is an operational thermopile. Such a system will produce electrical energy.

Thermopiles are used today in our submarines as an alternative or emergency source of electrical energy. In particular, this is on the nuclear submarines where the hot region is the wall of the reactor and the cold region is the hull of the submarine.

Present-day thermopile systems are very limited in the amount of power they can produce. The fundamental problem is that the basic thermocouple is not an efficient current generator, but rather, an effective voltage source. Research being conducted within U.S. Energy Resources, Inc., relates to a novel thermopile with a markedly improved efficiency over conventional thermopiles. The exhibit illustrates the difference between a conventional wire thermocouple and the novel design of U.S. Energy Resources.

Our design is based upon thin film technology. When the two wires are fused together, as we note again in the exhibit closest to the rail, it is typical that the area of interface between the two wires is similar to the cross sectional area of the wire. This leads to the greatest inefficiency.

With the employment of thin film deposition technology, it is possible to make the junctions between the two materials to be whatever size is desired. In addition, it is possible to have the areas of the hot junctions of the thermopile be larger than the areas of the cold junction.

In May 1981, U.S. Energy Resources, Inc., entered into a contract with the Battelle Memorial Institute in Columbus, Ohio, to have

Battelle's scientific staff evaluate thermocouple wire technology and make any recommendations which could lead to an improved electric power generation system based upon the thermopile concept.

As a result of this program, Battelle's scientific staff postulated that innovative applications of design, materials technologies, and thin film deposition techniques may be combined to produce a thermoelectric generator of higher efficiency, greater reliability, and at a cost lower than systems presently available.

As a result of the initial findings at the Battelle Memorial Institute, patent applications were filed on the new concepts. Upon completion of the research contract at the Battelle Memorial Institute, U.S. Energy entered into a contract with SRI International—formerly Stanford Research Institute—Menlo Park, Calif., to verify what was postulated at Battelle and also to do additional testing and research.

SRI confirmed the theories advanced at the Battelle Memorial Institute and the test results showed that our patent designs and the use of the large junctions in our thermopile system represent more than an order of magnitude increase in efficiency compared to an ordinary wire thermocouple.

This is a monumental achievement. Our new proprietary procedure for the first time makes thermopiles practical sources of electrical energy. To be effective, thermopiles must, as we said earlier, have a high-temperature reservoir from which they can extract thermal energy and at the same time, have a low-temperature reservoir to which they conduct this thermal energy.

In the next exhibit, the middle exhibit——

[Chart.]

Dr. Beale [continuing]. Details, as well as simplified applications of the thermopile energy system are shown. In the top portion of the figure, we show a simple schematic diagram of the high-efficiency thermopile utilizing the large junction concept for the conversion of heat energy to electrical energy.

In the middle two figures, we show applications. The high-energy thermopile concept is shown utilizing the waste heat from an electric utility. I want to emphasize that only waste heat is utilized.

Figure 2, the upper of the two middle figures, utilizes the low-temperature, saturated steam from the last stage of a turbine, which is useless for anything else because it is saturated steam; while figure 3, the lower figure in the middle, shows a more efficient use of the thermopile because of the higher temperature stack gases. The thermopile efficiency increases as the temperature of the high-temperature region increases.

In the bottom figure, we show the system reversed. Electricity is applied and the thermopile, then, can be used to produce a cooling effect. The U.S. Energy Resources' system has been designed so that it would produce electric power primarily.

Our thermoelectric generator will have no moving parts, low-maintenance cost, low-capital equipment investing cost, will be environmentally acceptable, can be retrofitted to existing equipment, and be able to convert waste heat energy to electric energy at a lower capital equipment cost than the present turbine generators.

Our next research effort was to enter into a contract with a faculty member at the Georgia Institute of Technology in Atlanta, Ga. The objectives of this research program are to conduct a theoretical analysis and perform calculations so that we could determine the configuration and materials for maximum efficiency of our prototype thermoelectric generator.

The results to date from all of the testing, designs, use of materials, use of thin film coating technology, and the analysis and theoretical calculations, indicate that we will have an efficiency rating of at least 6 percent on our thermoelectric generator. I should point out that 6 percent has been measured on an actual device at this time, so we are anticipating that as the calculations proceed further, we will approach an even higher efficiency.

Members of the committee, please focus your attention on our last exhibit, which is an example of what occurs at a 500-megawatt utility plant.

[Chart.]

Dr. BEALE. A fuel equivalent of 1,538 megawatts is consumed to produce those 500 megawatts of consumer-usable electrical power. The lost power represents 1,038 megawatts. Of the 1,038 megawatts, approximately one-half is nonrecoverable because it is lost as heat in the turbine bearings and various other inefficiencies throughout the system.

The 519 megawatts that remain are lost as wasted heat. The U.S. Energy Resources system is designed to recover at least 18½ megawatts from the 519 megawatts of wasted heat.

Now, we have allowed for additional inefficiencies and losses. We did not apply that 6 percent that I mentioned earlier. We are not that utopian or naive.

The following information is based on data found in the Statistical Abstract of the United States for 1981, National Data Book and Guide to Sources, published by the U.S. Department of Commerce, Bureau of the Census.

In 1980, the electric power generating capacity in the United States from conventional and nuclear steam generating plants was 481 million kilowatts. This does not include hydroelectric, gas turbine, or internal combustion engines used as prime movers to rotate these electric generators.

During the same year, the total production from all sources of prime movers was 2,286 billion kilowatt-hours. This is energy now, we are talking.

The proportionate sales for steam generating electricity would amount to 1,642,500 million kilowatt-hours. I am sorry, these numbers are so big, they stagger my tongue.

The average revenue in 1980 in the United States for kilowatt-hours sold was 4.37 cents, which has currently been revised to 5.12 cents. The average revenue today is approximately 7 cents per kilowatt-hour.

For the example that the U.S. Energy Resources' high-efficiency thermopile develops a maximum static efficiency of 6 percent, and utilizing the cited statistics, it can be seen—now, this is with correcting for our own inefficiencies—that if all steam-generating electric power utilities were retrofitted, an additional 17,702,000 kilowatts would be available. In terms of energy, this amounts to 60,585 million kilowatt-hours.

From this example, which is very realistic, it is obvious that the new applied technology of U.S. Energy Resources can have a significant impact on the energy availability of the future. It is the plan of U.S. Energy Resources, Inc., to build a prototype and have it available to be installed at a utility facility within the next 12 to 15 months.

Needless to say, all of us at U.S. Energy Resources, and also Omnimax, Inc., appreciate the opportunity to discuss this energy application with you and the members of your committee. If you have any questions that you would like to ask of Mr. Magerman at this time, or even of myself, we would be happy to answer.

Thank you.

[The prepared statements of Mr. Alan P. Magerman and Dr. Harry A. Beale and the charts mentioned above follow:]

TESTIMONY OF

ALAN P. MAGERMAN,
PRESIDENT
OF
OMNIMAX, INC.
PHILADELPHIA, PA

AND

DR. HARRY A. BEALE,
DIRECTOR OF RESEARCH
OF
U. S. ENERGY RESOURCES, INC.
PHILADELPHIA, PA

* * * * * * *

TO THE SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY
OF THE U. S. HOUSE OF REPRESENTATIVES
JULY 21, 1983

OMNIMAX
INC.
121 SOUTH BROAD STREET, 12TH FLOOR, PHILADELPHIA, PENNSYLVANIA 19107 (215) 546-1879

TESTIMONY OF
ALAN P. MAGERMAN, PRESIDENT
OMNIMAX, INC.
Philadelphia, PA
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OMNIMAX, INC.
PHILADELPHIA, PA
TO THE SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY
JULY 21, 1983

I wish to express my appreciation to Chairman Don Fuqua (D-Florida) and to members of the Committee for the invitation to testify before the Subcommittee on Energy Development and Applications on the subject of Tax Incentives for New Energy Technologies.

Omnimax, Inc. is a public company of which I am President and Chief Executive Officer. Our corporate objective is to coordinate new sciences for commercial applications through a network of subsidiaries. We currently have three subsidiaries; one of them is now a public company and the other two are wholly owned by Omnimax. Applied Coatings International is the public company; it is currently involved in the field of polymer coatings. General Molecular Applications is a wholly owned subsidiary advancing research in genetic engineering; and U. S. Energy Resources is another wholly owned subsidiary whose efforts have been directed in research and development in the field of thermoelectric engineering.

Our success, to date, is due to our ability to recognize the tax incentive programs created by Congress. Because we were provided with the existing tax incentives as a tool, we were able to subsidize research in both genetic engineering and polymer coatings; and we are now in the process of financing a prototype thermoelectric generator at U. S. Energy Resources, Inc. Furthermore, we are preparing a 1983 research and development tax incentive program which will focus on the development of new technologies. Programs such as our own serve to stimulate independent research while, at the same time, minimizing grant requests which inevitably find their way to the doorstep of government.

The quality of our future life in America has always been predicated upon our dedication to research today. The responsibility for that investment into research should not be borne by government alone, but should be shared by the private sector.

Omnimax exemplifies how the private sector and the government can mutually participate in the optimum advancement of research. We at Omnimax coordinate research in new sciences, with commercial applications of these sciences as our goal. The way in which we achieve this end is by forming subsidiary companies and, most importantly, by utilizing the research and development tax incentive programs made available to us by Congress.

At this point, I am pleased to announce that through research efforts which began at Battelle Memorial Institute and continued at Stanford Research Institute and Georgia Institute of Technology respectively, U. S. Energy Resources has developed a technology that will capture waste heat and convert it into low cost electricity. This applied technology will lower the utilities' effective cost of production immediately and will afford a tremendous savings to the American public.

Mr. Chairman, I would like to introduce Dr. Harry A. Beale, who is Director of Research and Development at U. S. Energy Resources, Inc. Dr. Beale will provide the Committee with a more detailed explanation of our new technology.

However before Dr. Beale speaks, I would like to thank you and the members of this Committee for giving Omnimax the opportunity to testify today; and I can assure this Committee that Omnimax will continue to conscientiously apply the economic incentives adopted by Congress for the good of all involved.

Thank you.

U.S. ENERGY RESOURCES INC.

TESTIMONY OF

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DIRECTOR OF RESEARCH
U. S. ENERGY RESOURCES, INC.
PHILADELPHIA, PA.
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* * * * * * * *

CHAIRMAN FUQUA AND MEMBERS OF THE COMMITTEE:

I appreciate the opportunity to explain to you what we have accomplished at U. S. Energy Resources, Inc. We have applied modern technology to a 50 year old device and demonstrated the potential for a dramatic improvement. Existing data now indicate the improvement is so great as to be a major breakthrough in increasing energy savings and electrical power production.

Briefly stated, our concept involves the thermocouple theory. As shown in the exhibit, when two different, properly selected materials are joined together, a voltage will be developed when heat is applied to their junction. This is a fundamental observation and the phenomenon is called thermoelectricity. As a matter of routine, thermocouples are presently used only for measuring temperature. When several thermocouples are connected in a regular pattern, a cool region provided for alternate junctions and a hot region for in-between junctions, the result is an operational thermopile. Such a system will produce electric energy. Thermopiles are used today in our submarines as an alternate or emergency source of electric energy. Present day thermopile systems are very limited in the amount of power they can produce. The fundamental problem is that the basic thermocouple is not an efficient current generator but, rather an effective voltage source.

Research being conducted within U. S. Energy Resources, Inc., relates to a novel thermopile with a markedly improved efficiency over conventional thermopiles. The exhibit illustrates the difference between a conventional wire thermocouple and the novel design of U. S. Energy Resources'. Our design is based upon thin film technology. When two wires are fused together, it is typical that the area of the junction between the two wires is similar to the cross-sectional area of the wire. With the employment of thin film deposition technology, it is possible to make the junctions between the two materials to be whatever size desired. In addition, it is possible to have the areas of the hot junctions of a thermopile to be larger than the areas of the cold junctions.

In May, 1981, U. S. Energy Resources, Inc. entered into a contract with the Battelle Memorial Institute, Columbus, Ohio, to have Battelle's scientific staff evaluate thermocouple wire technology and make recommendations which could lead to an improved electric power generation system based upon the thermopile concept. As a result of this program, Battelle's scientific staff postulated that innovative applications of design, material technologies, and thin film deposition techniques may be combined to produce a thermoelectric generator of higher efficiency, greater reliability, and at a cost lower than systems presently available. As a result of the initial findings at the Battelle Memorial Institute, patent applications were filed on the new concepts.

Upon completion of the research contract at the Battelle Memorial Institute, U. S. Energy Resources entered into a contract with SRI International (formerly Stanford Research Institute), Menlo Park, Calif., to verify what was postulated at Battelle and, also, to do additional testing and research. SRI confirmed the theories advanced at the Battelle Memorial Institute; and the test results showed that our patent designs and the use of the large junctions in our thermopile system are an order of magnitude more efficient than an ordinary wire thermopile. This is a monumental achievement. Our new proprietary procedure for the first time makes thermopiles practical sources of electric energy.

To be effective, thermopiles must have a high temperature reservoir from which they can extract thermal energy and, at the same time, have a low temperature reservoir to which they can conduct this thermal energy.

In the next exhibit, details, as well as simplified applications of the thermopile energy systems, are shown.

In Figure 1 is shown a portion of the high-efficiency thermopile utilizing the large junction concept for the conversion of heat energy to electrical energy.

In Figures 2 and 3, the high-efficiency thermopile concept is shown utilizing the waste heat from an electric utility. Figure 2 utilizes the lower temperature saturated steam from the last stage of a turbine while Figure 3 shows a more efficient use of the thermopile because of the use of the higher temperature stack gases.

In Figure 4, the system is reversed and electricity is applied to the thermopile to produce a cooling effect.

The U. S. Energy Resources' system has been designed so that it would produce electric power. Our thermoelectric generator will have no moving parts, low maintenance cost, low capital equipment investing cost, will be environmentally acceptable, can be retrofitted to existing equipment and be able to convert waste heat energy to electrical energy at a lower cost than present turbine generators.

Our next research effort was to enter into a contract with a faculty member at the Georgia Institute of Technology, Atlanta, Georgia. The objectives of this research program are to conduct a theoretical analysis and perform calculations so that we could determine the configuration and materials for maximum efficiency for our prototype thermoelectric generator. The results, to date, from all of the testing, designs, use of materials and use of thin film coating technology and the analysis and theoretical calculations indicate that we will have an efficiency rating of at least 6% on our thermoelectric generator.

Members of the Committee, please focus your attention on our next exhibit which is an example of what occurs at a 500 megawatt utility plant. A fuel equivalent of 1538 megawatts is consumed to produce 500 megawatts of consumer usable electrical power. The lost power is 1038 megawatts. Of the 1038 megawatts, one-half is non-recoverable because it is lost as heat in the turbine bearings and various other inefficiencies. The 519 megawatts that remains is lost as wasted heat. The U. S. Energy Resources system is designed to recover at least 18.5 megawatts from the 519 megawatts of wasted heat.

The following information is based on data found in the Statistical Abstract of the United States for 1981, National Data Book and Guide to Sources, published by the U. S. Department of Commerce, Bureau of the Census.

In 1980, the electric power generating capacity in the United States from conventional and nuclear steam generating plants was 481,000,000 kilowatts (kw). This does not include hydroelectric, gas turbine, or internal combustion engines used as prime movers to rotate the electric generators. During the same year, the total production from all sources of prime movers was 2,286,000,000,000 kilowatt hours (kwh). The proportionate sales for steam generated electricity would amount to 1,642,500,000,000 kwh. The average revenue in 1980 in the Unites States per kwh sold was 4.37 cents, which has been currently revised to 5.12 cents. The average revenue today is approximately 7.00 cents.

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It is the plan of U. S. Energy Resources, Inc. to build the prototype and have it available to be installed at a utility facility within the next 12 to 15 months.

Needless to say, all of us at U. S. Energy Resources and Omnimax, Inc. appreciate the opportunity to discuss this energy application with you and the members of the Committee. If you have any questions that you would like to ask me or Mr. Magerman at this time, we would be happy to answer them.

* * * * * * *

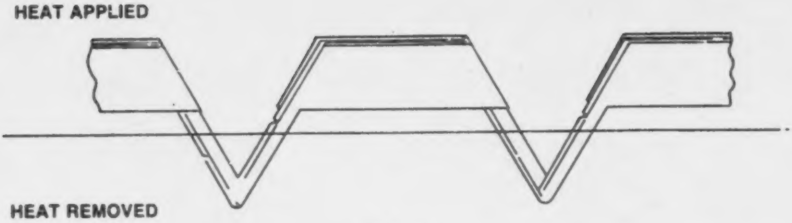

HEAT APPLIED
HEAT REMOVED

FIG. 1

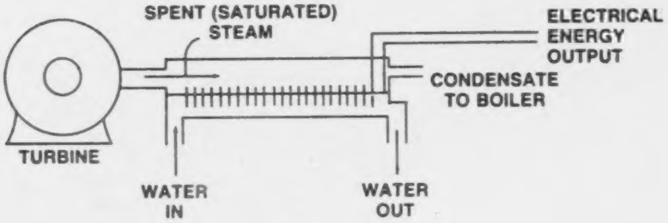

SPENT (SATURATED) STEAM
ELECTRICAL ENERGY OUTPUT
CONDENSATE TO BOILER
TURBINE
WATER IN
WATER OUT

FIG. 2

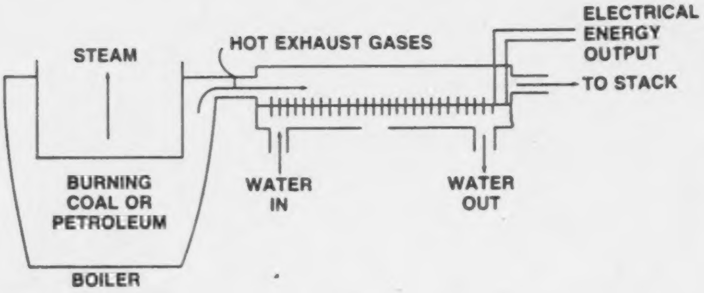

STEAM
HOT EXHAUST GASES
ELECTRICAL ENERGY OUTPUT
TO STACK
BURNING COAL OR PETROLEUM
WATER IN
WATER OUT
BOILER

FIG. 3

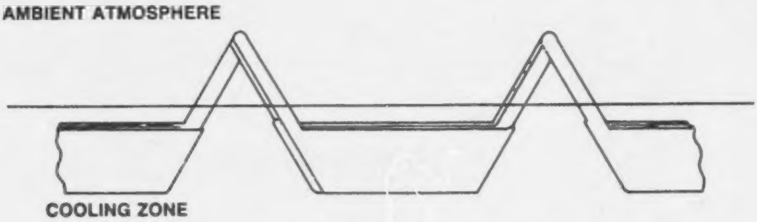

AMBIENT ATMOSPHERE
COOLING ZONE

FIG. 4

- Example — Plant Producing 500 Megawatts
- Input — Fuel Equivalent — 1538.46 Megawatts
- Output — System Produces — 500.00 Megawatts
- Lost in Process — 1038.46 Megawatts

- Additional Megawatts Produced
By U.S. Energy Resources' System
18.5 Megawatts

Mr. **Fuqua**. Thank you very much, Dr. Beale, and all of our witnesses.

Larry, what is your opinon for somebody like Southern Cal Edison for this type of operation?

Dr. **Papay**. I would like to give you a studied and detailed answer, but having just been exposed to it for the first time, I would like to talk to them about it. I was aware years ago of some thermoelectric research that was being done by other companies—a simple junction type. I can see, based upon what they say with the new approach on the thin films, that some of the objections that I was aware of then are certainly answered by the new technology.

I would like to talk to them about it and look into it. If I can defer answering at this point in time——

Mr. **Fuqua**. I can certainly appreciate that. I just thought that for a large utility company that has a lot of power-generating plants, it might look worthwhile.

Mr. **Papay**. As you know, we are looking at everything.

Mr. **Fuqua**. Yes, I know you are. [Laughter.]

Larry, there are a lot of people that claim that the utilities are hardly paying any taxes today and they should not be allowed to get any more tax credits. What is your answer to that?

Dr. **Papay**. It may be true in individual cases, and I know it was somewhat true in our case several years ago in terms of the tax burden because of construction programs and things of that sort. Certainly, it is not the case today.

I think the recommendation that I made on utility inclusion in energy tax credits is not to reap some sort of windfall benefit. Really, what we are looking at is the difference between having a project which is economically viable; that is, one able to meet an avoided cost test, and one which cannot meet that test. Even though our PUC has been quite considerate in allowing some measure of cost allowance above avoided cost in new technology development, I am afraid that in the case of many of these projects, absent the tax credit availability, we would be confronted with a no-go situation.

So it is not an attempt to increase our rate of return or anything like that since that is regulated. It is really an attempt to make the economic viability—make these projects economically viable.

Mr. **Fuqua**. How would the ratepayer of a utility—how would they benefit from a business tax credit? You mentioned this in your testimony.

Dr. **Papay**. In point of fact, ratepayers would benefit both from projects we are looking at with utility equity participation as well as projects we are not involved with; that is, third-party projects, but also the ones we are looking at where we are looking at utility equity participation.

That portion of the project that we would be funding, absent the tax credit, would be subject to treatment as standard utility property. this would cause a fixed-charge rate, which when coupled with the operating and maintenance costs, would give you an avoided cost—or would yield a cost to produce power in excess of our avoided cost.

By having the tax credit available, the effective fixed-charge rate, that is the effective capital on which the fixed charges are based, are reduced substantially, such that now when you take this reduced effective capital component and tie that with the operating and maintenance cost, gives you a levelized cost which approaches our avoided cost.

So the ratepayer, in essence, is not adversed by having a project proceed. He is not really being subsidized because the tax credit is not bringing it below avoided cost. It is a question of bringing it down to the avoided cost level.

Mr. FUQUA. Bennett, you stated on page 4 of your statement that the windfall profits tax of 1980 excluded biomass gasification from the 10-percent biomass tax credit, but it was not intended to do so.

What is the basis for that claim? Was it an oversight or was it an intentional oversight?

Dr. MILLER. I do not believe it was intentional. From the legislative history, Mr. Chairman, and in particular the conference report, it is quite clear that the original legislation was intended to exclude oil and gas type of feedstocks and oil and gas types of products. But the alternate energy property was not meant to exclude synthetic gases that are produced from an alternate substance.

It is on that basis that we believe that this was simply an oversight. I think the additional evidence is associated with the fact that the technologies that we are talking about at the time were just reemerging as potentially attractive and I do not believe that the Congress was trying to exclude reemerging technologies, but trying to insure that some of the more established ones did not get a windfall.

Mr. FUQUA. The officials at DOE have indicated to us that there are uncertainties over the reliability and performance and it may be holding back the market penetration of biomass conversion systems.

Would a Government testing program be of assistance?

Dr. MILLER. I do not believe, Mr. Chairman, that with respect to direct wood combustion and with respect to gasification that we need a lot more in the way of direct Federal support. These technologies are, I think, very close to the marketplace. We do believe that the energy tax credit and the extension of it are going to be the spurs to continued investment. We do not——

Mr. FUQUA. How about Government involvement in further research and development in advanced biomass gasification systems?

Dr. MILLER. There is no question that with respect to the more advanced technologies, continued Government support will be very valuable. This is especially true when the feedstocks change from wood and we begin to look at feedstocks that involve microalgae, feedstocks that are not generally acknowledged as being part of our immediate energy supply inventory.

I fully support an expanded biomass program at the Department of Energy.

Mr. FUQUA. Let me ask you and Mr. Zimmer, or both of you may want to comment on it. We are told, and arguments are made, that biomass and cogeneration are cost effective without the tax incentives; whereas solar and some of those technologies are less cost effective under the current market conditions. Therefore, because of the cost effectiveness, then tax incentives are not necessary.

Dr. **Miller**. I would be pleased to answer that, and I am sure that Mr. Zimmer will as well.

In very specialized circumstances, particularly those—and let me deal with the feedstock that everybody worries about, and that is the wood feedstock. There are certain circumstances where if someone can get the wood for nothing, wood waste for nothing, that the economics of these systems looks attractive. There is no question about that.

The fact of the matter is that the amount——

Mr. **Fuqua**. When you say "get for nothing," there is nothing free, but it would be like a pump mill using chips and tops and so forth.

Dr. **Miller**. Exactly, using what was formerly waste. Suddenly it becomes a resource. But, that resource is rapidly disappearing and what we have heard, not only from our members in the National Wood Energy Association, but from others outside as well, that even the forest products industry is going out and purchasing fuel. That changes the economics dramatically and that has reduced the economic advantage to the point where these kinds of projects are marginal, given current hurdle rates.

That does not mean that they are not economic, and it does not mean that we should not be encouraging them. But it just says that now the corporate balance sheet does not look quite so attractive as it did when the fuel was free.

Mr. **Fuqua**. Mr. Zimmer.

Mr. **Zimmer**. I would like to speak to that as well, Mr. Chairman. There are several points, I think, that need to be made on that issue. While in selective instances, perhaps projects may appear to be economical, that type of argument ignores several, I think, more fundamental considerations.

No. 1, it ignores the realities of how projects are actually being financed. As I indicated in my oral statement, we are seeing more and more movement into third-party development and financing of these types of projects where the underlying availability of energy tax incentives of the nature we are talking about are very essential in terms of making that type of third-party commitment with respect to raising funds for these projects.

Second point I would make in that regard is that under conventional hurdle-rate analysis being employed by energy users, these projects, although they may appear economic, and may end up being attractive, in the competition within corporations for limited available capital funds, these projects end up stacking up somewhere in the middle. In terms of project opportunities with most of the major corporations investing money currently in projects perhaps that are providing returns within a period of 1 year to 1½ years, a good number of these cogeneration projects, instead, although they are economical and attractive, are providing returns more in the range of 2, 2½ to 3 years and maybe even 4 years.

A final point I would make in that regard is that there is a whole market out there involving projects that are probably under $20 million and a market that is commercial in nature, rather than industrial, in which the underlying economics is a little bit different than exists in an industrial context. The role of tax incentives in that market situation is important, and can play a meaningful role.

Mr. FUQUA. Well, in a Resource Planning Associates' recent study that they made, they said that extending the cogeneration tax credit to 1990 would increase the oil saved from cogeneration from a level of 185,000 barrels a day to a level of 210,000 barrels a day. Now, that would indicate that a lot of cogeneration is going to take place without the tax credits.

Why should we extend the tax credits for this technology at this particular time?

Mr. ZIMMER. I believe in terms of the RPA study and the underlying projections that you are citing, Mr. Chairman, as well as many of the other studies that have been done on the whole issue of the effectiveness of energy tax credits, whether it be cogeneration or the other technologies that we are discussing today, there has not been in any of those studies a proper focus on the realities of how projects are actually financed, and second, the critical involvement, third-party financing.

As I indicated in the recent analysis done at Argonne National Laboratories last year, in just the small sphere of gas-fired cogeneration, 66 percent of those projects are going to be brought on line through third-party financing. Most of the surveys and most of the analyses that are being conducted are based upon techniques which approach the users and say, "Would you invest in such-and-such equipment or facilities under a variety of different alternatives?"

Those investments are not going to be made necessarily by those users. In fact, the investments are ultimately going to be made, not by the users, but by third parties. There needs to be a broadening of the survey base and technique to develop a more meaningful analysis, in my judgment, on the underlying issue or question of effectiveness of energy tax credits.

Mr. FUQUA. You stated that the cogeneration tax credits would actually increase the revenues to the Treasury. Can you cite me an example of how that would happen?

Mr. ZIMMER. There are several instances which I can specifically cite in that regard, Mr. Chairman. The Treasury Department, in its analysis and development of revenue loss figures on any of these energy tax credit measures, does not take into account necessary feedback effects which occur with respect to these tax credits. These are of a several-fold nature: First, we are reducing the usage of energy through the more efficient use of that energy.

As you know, we are picking up in efficiencies from 33 percent without cogeneration up to 75 to 80 percent. That efficiency increase reduces the tax deductions that are taken by those very users with respect to fuel costs, as an ordinary, necessary business expense under the Internal Revenue Code.

Second, the economic activity spurred and motivated by bringing the technology on line through the energy tax incentives create jobs and additional activities of a taxable nature that have that feedback or offsetting effect to counterbalance the revenue loss associated with providing the tax credit up front.

A specific example of that was cited in my statement on analysis done by one of our members regarding the removal of the oil and gas limitation alone if the cogeneration tax credit were reenacted. That one action, if taken by the Congress, would result in the creation of probably 10,000 jobs and the additional development of $2 billion of equipment manufacturing in the depressed equipment manufacturing industry today just associated with gas-fired cogeneration equipment.

You are also going to be hearing, I think, further analysis and information in the next panel on this question from Booz, Allen & Hamilton.

Mr. FUQUA. Thank you.

Dr. Magerman, in your testimony, as I understand it, the testing and research was carried out basically at private-sector laboratories, such as Battelle and SRI. There is no Government funding involved in the testing or development work of your concept.

Dr. MAGERMAN. That is correct.

Mr. FUQUA. How would tax incentives—do you use any tax incentives for this development?

Dr. MAGERMAN. No, we did not, Mr. Chairman.

Mr. FUQUA. How would they help you? How would this bill we are talking about help you?

Dr. MAGERMAN. Well, in my testimony, I mentioned that we have used the tax incentive program successfully. One program which I referred to was a R&D program that we used in arranging for the research funding to General Molecular Applications, which is our genetic company. We are pleased about our research advancement in genetics which has occurred because of this research and development tax incentive program. We have also used a research and development program successfully in Applied Coatings International, which is a public company of which we are a large stockholder.

At U.S. Energy Resources, we chose 2 years ago to fund the initial research program ourselves, but to use a tax-incentive program for the development and building of the prototype. That is what we are currently doing.

So it would help us enormously because it would be a way for the private sector to literally invest in their future.

Mr. FUQUA. Then, would this bill assist you in getting development funds for a marketable product?

Dr. MAGERMAN. Yes. What we are here for today is to encourage the research and development tax incentive programs in all areas.

Mr. FUQUA. Would this be helpful in raising developmental capital?

Dr. MAGERMAN. Yes, it would. Extremely so.

Mr. FUQUA. Mr. Nelson.

Mr. NELSON. Thank you, Mr. Chairman.

I wanted to ask Dr. Beale, from his statement of the 6-percent efficiency, and if you applied that to the entire company, you would be capturing an additional 17 million-plus kilowatts. I think a very dramatic underscoring of that point would be if you could equate that to how many less barrels of oil we would have to import into this country. Do you have any idea?

Dr. BEALE. I did not bring my slide rule today.

Mr. NELSON. Well, it is hard to calculate because part of the existing power is coming from oil; part of it from coal.

Dr. **Beale**. The simple way is to state that there will be a great savings in cost and a dramatic drop in full usage.

Mr. **Nelson**. But it does mean that we move toward our goal of energy independence a little further——

Dr. **Beale**. Yes.

Mr. **Nelson** [continuing]. And it is very important in my judgment.

Dr. **Beale**. It would translate into saying that we reduce that 6-percent efficiency to what you actually see at the end of the machine because of electrical connections, heat conversion, and various other things. So you will be seeing then about 4 percent real measurable efficiency.

That is why this number, the 18½ megawatts, does not represent 6 percent of the upper numbers.

Mr. **Nelson**. Well, is it a fair statement to say that you are——

Dr. **Beale**. You would be importing or utilizing 12 percent less fuel.

Mr. **Nelson**. OK. In other words, you are capturing 4 percent more electricity——

Dr. **Beale**. That is right.

Mr. **Nelson** [continuing]. Than had been the case if this device were applied to all of the——

Dr. **Beale**. You would have two alternatives at that point; to either have 4 percent more energy to use; or to utilize 12 percent less fuel to begin with, still producing the same amount of electrical energy as today.

Mr. **Nelson**. I think that is pretty dramatic.

Tell me, in the process of developing this, to what extent have you all discussed with utility company executives or the Research Institute the taking of your device and putting it on?

Dr. **Beale**. We have discussed this with Philadelphia Electric and they want us to reduce the time—they want it in their facility in less than 12 months.

Mr. **Nelson**. So that is going to be your first demonstration?

Dr. **Beale**. I will let Dr. Magerman answer that one.

Dr. **Magerman**. We have had preliminary discussions with Philadelphia Electric Co. during the past several months and on one occasion we talked about making the prototype available for installation in a chosen facility. That is about as far as we have proceeded. We decided, Congressman Nelson, that the first thing we wanted to do was really put together the program ourselves; finance it, build a prototype ourselves, and then have the necessary discussions with Philadelphia Electric Co. for the installation 'procedure. We did not want the utility industries to feel that we are looking for financial help.

Mr. **Nelson**. What do you expect are your projected capital costs in this first venture?

Dr. **Magerman**. Of the prototype?

Mr. **Nelson**. Yes, with Philadelphia Electric.

Dr. **Magerman**. The cost that we are projecting now is in the area of several million dollars. That is for the prototype.

Mr. **Nelson**. That is money that you will raise yourself——

Dr. **Magerman**. Yes.

Mr. **Nelson** [continuing]. Or in a joint venture with a utility?

Dr. MAGERMAN. Yes, we will raise that money through a tax-incentive program and because of that option we have decided at this time not to form any joint ventures with the utility company.

Mr. NELSON. Do you have any projected minimum electricity sales price that you project would be the cost that you would sell this electricity that you produce from your device? Would that go at the going rate of electricity, or is there a projected sales price for it?

Dr. BEALE. That is going to be an area that the utilities will rule on. In other words, we are not trying to set up to compete with the utilities.

Mr. NELSON. Thank you, Mr. Chairman.

Mr. FUQUA. Thank you, Mr. Nelson.

Mrs. Schneider.

Mrs. SCHNEIDER. I regret that I had a satellite commercialization hearing going simultaneously with this one, so that I did not have the opportunity to hear the brilliant testimony that all of you have presented. I am quite sure that my chairman has asked all of the pertinent questions, so I do not wish to be redundant.

But I would like to ask if there are any points that all of you feel, each individual feels, that need to be made before we move on to the next panel, seeing as how I am the last one to question.

Are there any other things that you would like to bring to our attention that we may have overlooked? Yes.

Dr. MAGERMAN. The only thing that I would like to say to the committee is that I think it is very important for research and development investments to be made today so that we can have a better life tomorrow. I think that this country has always made research investments at a time when it understood that the real benefits would be realized in the future.

I think today's research and development is an extremely important investment which can insure a better way of life for all of us.

Mrs. SCHNEIDER. Thank you.

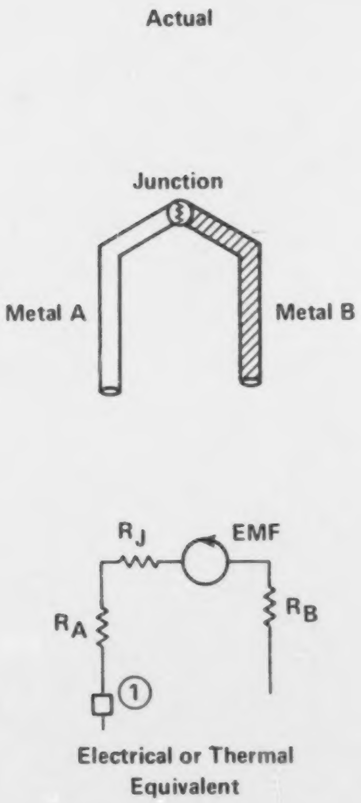
Any other comments? Yes, Dr. Papay.

Dr. PAPAY. I think the questions of the energy tax credits have been extremely important in moving the R&D program dealing with renewable and alternative technologies to the point where they are today.

The drop in world oil prices implies that the tax credits are needed even more to fully realize the dream that I think a lot of people have had in terms of bringing these technologies to commercial fruition. I think it makes good energy policy, good environmental policy, good trade policy, as well as good economic policy, to extend the credits, and, from our perspective, to include the utilities in those.

There are a whole host of projects sitting out there which will not occur, I am quite sure, if the tax credits are not present. I cannot guarantee the projects will go forward if the tax credits are there, but I can almost guarantee that the projects will not go forward absent that. Thank you.

Mrs. SCHNEIDER. Let me just add that I share your concern and I wholeheartedly believe that our country does not now have a national energy policy that we are operating in a very flexible environment, and it holds a great priority, insofar as I am concerned,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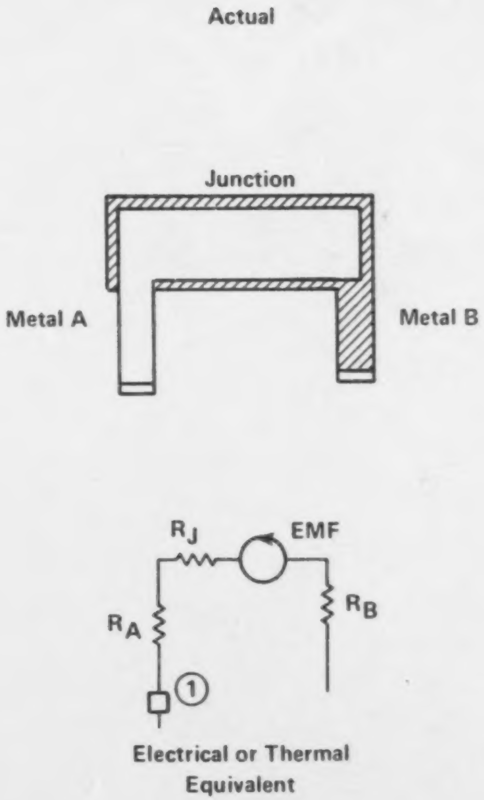
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in addressing the energy independence issue and recognizing that the two parameters that we have to focus on are supply and pricing.

It seems to me that certainly the incentive of tax credits is one that will help move us toward greater energy independence and greater assurance to the consumer that they will have not only the supply, but also the price of energy that is reasonable.

I am hopeful that those members who were not in attendance today will take the time to read the testimony and that we can help the chairman move this legislation along.

Mr. ZIMMER. May I make one brief comment?

Mrs. SCHNEIDER. Yes.

Mr. ZIMMER. I think that your observation is an extremely cogent one. I think on this whole issue within the Congress, the issue of tax credits jurisdictionally has been under the purview of the tax-writing committees. But that process has not reflected, as you have very clearly indicated, any underlying incorporation of the role of energy tax credits as a tool or an element of a national energy policy. I think an important role can be served here and certainly, as you are alluding my fellow colleagues who are not members of those tax-writing committees, but who can certainly present that viewpoint and input from an energy policy perspective to guide their deliberations.

Mrs. SCHNEIDER. Yes. Thank you.

Thank you very much, Mr. Chairman.

Mr. FUQUA. I might say their testimony was very excellent and I would recommend it.

We want to thank all of you for being here today and for your testimony and contributions. Thank you very much.

Our next panel will consist of Peter B. Bos, president of Polydyne, Inc., of Menlo Park, Calif.; Joseph M. Schell, vice president, Kidder, Peabody & Co. of N.Y.; and William H. Babcock, senior associate of Booz, Allen & Hamilton, in Bethesda, Md.

Mr. Bos, we will be pleased to hear from you, and as I indicated to the first panel, if you do—which you do all have prepared statements—if you wish to summarize them, we will make your prepared statement part of the record.

STATEMENTS OF PETER B. BOS, PRESIDENT, POLYDYNE, INC., MENLO PARK, CALIF.; JOSEPH M. SCHELL, VICE PRESIDENT, KIDDER, PEABODY & CO., INC., NEW YORK, N.Y.; AND WILLIAM H. BABCOCK, SENIOR ASSOCIATE, BOOZ, ALLEN & HAMILTON, BETHESDA, MD.

Mr. Bos. Thank you, Mr. Chairman.

Mr. Chairman, members of the committee, I am pleased to appear before you to testify on the subject of proposed modifications to the Federal energy tax credits for solar, wind, and geothermal power technologies.

I am Peter Bos, president of Polydyne, Inc., a management consulting and systems engineering services organization based in Menlo Park and Berkeley, Calif. Polydyne specializes in comparative analyses and commercialization of advanced small power technologies, including renewable energy systems, geothermal power, cogeneration and fuel cells.

The company has special experience in combining the technical, economic, financial and utility interface aspects of alternative advanced power generation technologies.

Prior to founding Polydyne, I was director of the department for New Energy Resources Development at the Electric Power Research Institute at Palo Alto, Calif., for a period of 6 years.

In that position, I was responsible for the planning, direction and control of the utility-sponsored national solar, wind, geothermal and fusion programs.

Mr. Chairman, because of the time limitations, I have a prepared statement that I will summarize in this hearing.

My associates and I have been conducting a number of studies and analyses which bear directly on this subject of today's hearing. My comments to the committee reflect the results of these ongoing efforts and analyses related to commercialization of these technologies.

In particular, I will briefly address the following subjects: First, the effects of the recent tax incentives on the development and commercialization of renewable energy technologies, specifically wind, solar thermal and photovoltaic systems; and secondly, the appropriate level and extent in time of investment tax credits and other incentives necessary to underwrite the commercialization of viable alternative energy concepts.

In just the past decade there has been significant progress in research, development and demonstration of selected renewable energy technologies. More recently, in the past 4 years, we have witnessed the first phases of commercialization of selected wind, solar thermal and photovoltaic systems by industry. These initial commercialization efforts have been to a major extent stimulated by the various Federal and State tax incentives that have been enacted to underwrite the differences between the installed costs and the economic values for these technologies.

These differences between cost and economic value can be viewed as the extraordinary risk taken by industry, which are the risks above the normal business conditions, associated with the introduction of new technologies.

These tax incentives have had the favorable effect of combining the financial sector with the technical and manufacturing communities in this technology commercialization process. This symbiotic process has resulted in the demonstration of the economically most viable and technically most mature renewable resources technologies.

An important issue in this context is that wind and solar power concepts currently reflect widely diverse technologies and stages of development. The extent of specific tax credits, both in time and in amount, necessary for commercialization of small wind machines will not necessarily be adequate to stimulate commercialization of more advanced and potentially economically viable solar thermal technologies or photovoltaic systems.

There are potentially attractive solar and wind technologies which, due to inherent technical and physical complexities, require further research and development prior to initiation of the commercialization efforts.

Premature phasing out of tax incentives would seriously impair the development of these potentially very desirable energy resources.

Currently, several factors threaten to undermine these early commercialization efforts. These factors include: the unforeseen drop in oil and gas prices that has occurred in the marketplace during the last two years; recent changes in perceptions about future energy prices, which are now expected to rise more slowly than projected just a few years ago; as a result of these and other factors, avoided costs and associated escalation projections have dropped recently.

Finally, several changes in tax incentives, both at the State and Federal levels, have the effect of significantly decreasing the economic value of these technologies: First, the Tax Equity and Fiscal Responsibility Act of 1982 has changed the depreciation base from the earlier Economic Recovery Tax Act guidelines; secondly, the scheduled abrupt termination of the California State energy tax incentives by the end of this year; and finally, the scheduled abrupt termination of the Federal energy tax credits by the end of 1985, without affirmative commitments in place.

Without such affirmative commitment legislation, investors perceive very high risks, since missing the deadline by only 1 day would imperil the entire project.

Because of all of these factors, the current risks perceived by the financial community and the associated cost of financing are much higher than they would otherwise be, significantly impairing the commercialization processes now under way in these various wind and solar technologies.

I would like to refer to table 1 to show you the impact of the various factors on investment value of wind energy systems. Starting with the 1981 perspective of the then current oil price and escalation scenario, combined with the tax credit provisions of the ERTA and California tax legislation, the investment value for a wind farm starting operation in 1985 was calculated. For a modified internal rate of return and risk rate of 24 percent after taxes, the investment value at that time was about $3,976 per kilowatt [rated] in 1982 dollars.

With the subsequent drop in oil prices and associated perceived lower escalation, this investment value decreased to $2,957 per kilowatt [rated]. In addition, the reduction in the depreciation base as a result of the TEFRA further decreased this investment value to $2,712 per kilowatt [rated].

The scheduled termination of the California State tax credits by December 31, 1983, further reduces this investment value to $2,054 per kilowatt [rated].

Finally, the expiration of the Federal energy tax credits by the end of 1985, without affirmative commitment as provided for by the ERTA legislation, brings the investment value of a wind farm down to $1,814 per kilowatt [rated] subsequent to this time period. This is a factor less than two times the original perceived value.

Since the expected installed costs for the more mature small turbine wind famers are projected to be $2,500 per kilowatt [rated] for

1985 operation, while the larger wind turbine wind farms are estimated to cost $3,250 per kilowatt [rated] for 1985 operation, the investment value, without any tax credits, falls significantly short of these projected costs.

This projected shortfall would seriously undermine the continued commercialization of this technology. The case for solar thermal and photovoltaic systems, because of their current stages of development, is even more severe than the wind farm case illustrated above.

These technologies, even though perceived to be economically viable during the 1995 time period, (after the proposed tax credits expiration), are caught in a typical Catch-22 situation: In order for commercialization to proceed, the projected installed cost must come down the learning curve in manufacturing. To realize these necessary installed systems cost reductions, however these systems in turn require significant market penetration and associated increased production.

The current and proposed tax incentives provide the underwriting of this discrepancy between value and installed costs during initial phase of commercialization by enhancing the market value associated with these particular systems sufficienty to attract risk capital from intermediate investors or third-party investors.

As a result, Polydyne has evaluated the impact of the proposed energy tax credits under H.R. 1775 on the commercialization of selected wind, solar thermal and photovoltaic technologies. The result of these analyses are summarized in tables 2 through 5 and Figures 1 through 4 which I have included in the submitted written testimony.

These tables and figures are for small and large wind turbine systems, solar thermal central receiver plants, and photovoltaic systems, respectively.

As can be seen from these results, the wind and solar technologies analyzed, all have the expectation of achieving commercial viability under normal business risks and incentives without any further tax credits in existence after the 1995 time period.

However, the early installed systems cost associated with these technologies during this first phase of the commercialization are substantially higher than the respective values computed under normal business investment conditions.

As an example, I would like you to examine table 3 which shows cost versus value over time for different energy tax credit scenarios, in this case, applied to large wind turbine farms.

The effect of the proposed H.R. 1775 legislation is to increase investment value from the $1,814 per kilowatt, without tax credits, to $2,530 per kilowatt for wind a farm operational in the 1985–86 time period.

When combining the effects of the proposed Federal legislation, with the proposed extension through 1986 of the California energy tax credits, the investment value in 1985–86 is increased to $3,072 per kilowatt [rated] for large turbine wind farms.

As can be seen from this table, this value is about equal to the corresponding expected installed cost during this time period.

Similarly, investment values during the 1990 time period, reflecting the proposed H.R. 1775 legislation without any further available State energy tax credits, fairly match the corresponding expected installed costs of the various wind and solar technologies considered in this analysis.

These effects are also shown graphically in figure 2 for large-turbine wind farms and in figures 1, 3, and 4 for small wind turbine farms, solar thermal central receivers, and photovoltaic systems, respectively.

Mr. FUQUA. Mr. Bos, what is the difference in your tables of cost and value? You have listed——

Mr. Bos. The cost, Mr. Chairman, is the total price for the installed system which we calculated from projections which we have conducted over the past number of years, whereas the value of the facility is determined by the details of the economic and financial conditions associated with the financing of such a system. Its value is the maximum price that can be paid for a system, subject to the various tax and legislative constraints, expected system performance, current and projected avoided costs, the cost of capital, prevailing interest rates, and the minimum acceptable after-tax required rate of return to investors.

So on the one hand, we have the value as calculated from an investment point of view; on the other hand, we see the cost as determined from detailed cost analysis of the installed system.

Comparing the value and cost, then, would give either the excess or the shortfall in terms of financing of the commercialization process.

This is also shown graphically in figure 2, to which I may refer you, for large wind farms. Also included in the written testimony are figures for the other technologies. Shown in this particular figure are installed costs corresponding to three different scenarios: expected, optimistic and pessimistic projected cost scenarios, and the values calculated from the various investment conditions, assuming various scenarios for tax incentive legislation.

When comparing the value and cost, the condition where the value equals the cost is the breakeven point. For example, as you can see, in this figure, in 1995, the expected cost equals the value without energy tax credits, which means that commercialization without any further tax credits could proceed.

Prior to this time, the expected cost is higher than the value and some underwriting of the extraordinary risks, as compared to normal business risks, would have to occur, which can be provided by the enactment of the various proposed tax incentives.

Shown respectively are the values corresponding to the proposed H.R. 1775, energy tax credits, which is the next line above it, which shows a breakeven in the 1988 time period. If the proposed California tax credits extension is assumed concurrently, the breakeven would be in the 1985–86 time period.

Obviously without these proposed tax legislations in place, the value as perceived by the investors would be significantly below the projected initial installed costs have determined from our detailed cost and market penetration analysis of these technologies under different scenarios.

Therefore, the proposed tax incentives of H.R. 1775, Renewable Tax Energy Act of 1983, combined with the current and projected California energy tax credits, are found to be necessary to sustain the commercialization of these technologies during the periods 1983 to 1994.

The cases shown in boldface in tables 2 through 5 indicate the situations for a given year in which the investment value first exceeds the projected—expected case scenario—installed costs. The projected cost under uncertainly for the wind, solar thermal, and photovoltaic systems reflect the Polydyne, Inc., integrated market and cost analyses conducted for the Bonneville Power Administration in 1982.

Since I am out of time, I will not discuss the impacts of this proposed legislation on the U.S. Treasury, and move on to my conclusions.

Based upon our analyses to date, we have concluded that there is a strong case for the continued underwriting, especially at the Federal level, of the extraordinary risks for the solar and wind technologies through an extension and increase of the energy tax credits as proposed under H.R. 1775.

This analysis also indicates a strong case for continuation of the State tax credits, especially in the States that are pivotal for commercialization of renewable energy technologies.

In summary, the proposed legislation will have the desired effect of insuring the successful commercialization of economically viable renewable energy resources, a process which was only initiated less than a decade ago. The benefits in terms of providing alternative energy resources, which are nondepletable, are projected to be very large, whereas the associated costs are relatively small.

Again, I would like to thank you, Mr. Chairman, for the opportunity to address this committee on this very important issue. I will be very glad to share with you any additional information that we have developed in connection with this topic.

Thank you.

[The prepared statement of Mr. Bos follows:]

Testimony of

Peter B. Bos

President
Polydyne, Inc. and Associates
Berkeley and Menlo Park, California

Before the

Subcommittee on Energy Development and Applications
Committee on Science and Technology
U.S. House of Representatives

July 21, 1983

Washington, D.C.

Introduction

Mr. Chairman and Members of the Committee. I am pleased to appear before you to testify on the subject of proposed modifications to the federal energy tax credits for solar, wind and geothermal power technologies.

I am Peter B. Bos, President of Polydyne, Inc., a Management Consulting and Systems Engineering Services organization based in Menlo Park and Berkeley, California. Polydyne, Inc. specializes in comparative analysis and commercialization of advanced small power technologies including renewable energy systems, geothermal power, cogeneration and fuel cells. The Company has special experience combining technical, economic, financial and utility interface aspects of alternative advanced power generation technologies. In the renewable energy field, this includes extensive and continuous contact with many of the major solar thermal electric, wind and photovoltaic projects throughout their history.

Prior to founding Polydyne, I was Director of the Department for New Energy Resources Development at the Electric Power Research Institute for six years. In that position, I was responsible for planning, direction and control of the utility-sponsored national solar, wind, geothermal and fusion programs.

My associates and I have been conducting a number of studies and analyses which bear directly on the subject of today's hearings. My comments to the Committee reflect the results of these ongoing efforts and analyses related to commercialization of these technologies.

In particular, I will address briefly the following subjects:

- The effects of the recent energy tax incentives on the development and commercialization of renewable energy technologies, especially wind, solar thermal and photovoltaic systems.
- The appropriate level and extent in time of investment tax credits and other tax incentives necessary to underwrite the commercialization of viable alternative energy industries.

Development and Commercialization of Renewable Energy Technologies

In just the past decade there has been significant progress in research, development and demonstration of selected renewable energy technologies. This accomplishment reflects primarily the joint efforts of private industry and government. More recently, in the past four years or so, we have witnessed the first phases of commercialization of selected wind, solar thermal and photovoltaic technologies by industry. These initial commercialization efforts have been to a major extent stimulated by the various federal and state tax incentives that have been enacted to underwrite the differences between the installed costs and the economic values for these technologies. These differences between cost and value can be viewed as the extraordinary risks (i.e., risks above the normal business risks) associated with the introduction of new technologies. For solar and wind systems, these extraordinary risks (which are common to the introduction of any new technology) have been largely underwritten by the various federal and state tax incentives. This is in contrast to a policy of direct government funding or subsidy of specific technologies such as during the earlier and current research and development phases.

This type of incentive structure has been extremely important in transferring the commercialization process to the private sector. These tax incentives have had the favorable effect of combining the financial sector with the technical and manufacturing communities in this technology commercialization process. This symbiotic process has resulted in the demonstration of the economically most viable and technically most mature renewable resources technologies.

Consequently, the government role of providing a variety of investment tax incentives has been directed towards the marketplace diffusion of the technology rather than towards the direct support of the many potential alternatives. The approach of using tax incentives transfers the decision-making process to the private sector. This induces the objectivity essential for the selection of preferred technology concepts. In contrast, it is very difficult to end direct government program support for a specific technology, even though it becomes clear that alternatives are more attractive.

Another important issue is that wind and solar power concepts currently reflect widely diverse technologies and stages of development. The extent of specific tax credits, both in time and amount, necessary for commercialization of small wind machines will not necessarily be adequate to stimulate commercialization of more advanced and potentially economic solar thermal central receiver technologies or photovoltaic systems. There are potentially attractive solar and wind technologies which, due to their inherent technical and physical complexities, require further research and development prior to initiating commercialization efforts. Premature phasing out of the tax incentives would seriously impair the development of these potentially very desirable energy resources. Carefully selected energy tax credits (rather than direct subsidies), place the commercialization process where it belongs - in the market place, where the decisions are based upon both the financial and technical merits of a project rather than by the advocacy of any specific technical approach.

However, several factors threaten to undermine these early commercialization efforts. These factors include:

- The unforeseen drop in oil and gas prices (and energy prices in general) that has occurred in the marketplace during the past two years.
- Recent changes in perceptions about future energy prices which are now expected to rise much more slowly than projections of just a few years ago.
- As a result of these and other factors, avoided costs and associated escalation projections have dropped recently, notably in those states such as California where the potential for wind and solar power generation is especially high. In California, peak avoided costs for electricity have dropped from about $0.08/kW-hr two years ago to $0.06/kW-hr today, and forecasted future price escalations have decreased from three percent per year (real) to no increase above inflation in short term, and two percent per year real over the long term.
- Several changes in tax incentives, both at the state and federal levels, have the effect of significantly decreasing the (calculated) economic value of these technologies:
    - The TEFRA legislation has changed the depreciation base from the earlier ERTA guidelines.

- The scheduled abrupt termination of the California state energy tax incentives. California is a pivotal state for early commercialization due to very good solar and wind resources and sites, relatively high avoided costs, a supportive Public Utilities Commission, favorable renewable energy tax legislation, and an informed utility industry with regard to these technologies.

- The scheduled abrupt termination of the federal energy tax credits by the end of 1985, without affirmative commitments in place. Without such affirmative committment legislation, investors perceive very high risks, since missing the deadline by only one day would imperil the entire project.

Because of all of these factors, the current risks perceived by the financial community and the associated cost of financing are much higher than they would otherwise be, significantly impairing the commercialization processes now underway in these various wind and solar technologies.

Consequently, in addition to these high financing costs, some of the technologies currently in the development and demonstration phases (including solar thermal electric, large wind turbines and photovoltaics) which still must realize cost reductions due to learning experience in manufacturing, will be effectively eliminated from the commercialization process. These technologies, even though projected to be economically viable during the 1995 time period, are caught in a typical "Catch-22" situation: In order for commercialization to proceed, the projected high early installed costs must decline. To realize the necessary installed systems cost reduction, these systems in turn require significant market penetration and associated increased production. The current and proposed tax incentives provide the underwriting of this discrepancy between value and installed cost during the initial phase of commercialization by enhancing the market value associated with these systems sufficiently to attract risk capital from intermediary investors.

Integrated Market and Financial Analyses of Solar and Wind Systems

(1) Financial Analysis Background and Methodology

During the last several years, we at Polydyne have been examining the integrated market and financial aspects of the development and deployment of solar electric, wind, cogeneration and fuel cell technology. This work has been conducted for a variety of clients including the Bonneville Power Administration, the U.S. Department of Energy (Bos, 1982), Sandia National Laboratories, the Electric Power Research Institute, and private industry. In the course of conducting these studies, Polydyne, Inc. has:

- Established a comprehensive technical and economic data base and market analysis for solar electric, wind and fuel cell technologies.

- Developed unique analytic tools which permit the integration of market potential, market penetration projections and learning curves for major technology components and subsystems, to obtain projected overnight construction prices for wind and solar power plants over time. This analysis explicitly incorporates considerations of uncertainty by defining optimistic, expected and pessimistic scenarios with regard to rate and scale of market penetration, system technical performance, project costs and contingencies.

- Developed detailed and comprehensive financial analysis programs for utility financing, third-party (intermediary) financing and R&D Limited Partnership financing of advanced power systems technologies.

- o Conducted preliminary analysis of the impacts of the federal and California energy tax incentives for Sandia National Laboratories, Livermore and the California Energy Commission.

These studies and analytical capabilities have been employed in examining the significance of the federal and state energy tax credits. Polydyne, Inc. has developed an integrated analysis to examine the impacts of alternative tax credit scenarios on the commercialization of solar and wind technologies. We believe that our analysis may be unique in that it combines detailed technical considerations, market potential assessment and market penetration dynamics, and economic and financial analysis in a consistent manner.

Projected total installed prices for solar and wind power generation systems were developed by Polydyne for the Bonneville Power Administration (Bos and Weingart, 1983). The integrated market, economic and financial programs permit conducting detailed analyses of various types of investments in wind, solar and other advanced power generation and cogeneration technologies. These programs incorporate specification of all of the relevant economic, technical and financial parameters, and permit calculation of the maximum affordable price (in $/kWe of installed capacity) for the facility. The detailed features and an example of data input and calculated output are included in the addendum to this written submission.

As a result of the invitation to us by this Committee, we have used this program to examine the impact of current and proposed tax incentives on the commercialization of solar and wind power generation technologies. This analysis covers the period from just prior to the establishment of PURPA and ERTA to the present.

(2) Results of the Integrated Analysis for Wind and Solar Technologies

To provide a historical perspective for the investment value of the energy tax credits, the maximum permissible installed costs using intermediary financing were calculated. The result of this analysis are shown in Table 1. Starting with the 1981 perspective of the then current oil price and escalation scenario, combined with the tax credit provisions of the ERTA and California tax legislation, the investment value for a wind farm starting operation in 1985 was determined. For a modified internal rate of return and risk rate of 24 percent after taxes, this investment value is $3976/kW(rated) in 1982 dollars. With the subsequent drop in oil prices and associated perceived lower escalation, this investment value decreases to $2957/kW(rated). In addition, the reduction in the depreciation base as a result of the TEFRA legislation further decreased this investment value to $2712/kW(rated).

The scheduled termination of the California state tax credits by December 31, 1983, further reduces the investment value to $2054/kW(rated). Finally, the expiration of the federal energy tax credits by December 31, 1985, without affirmative committment, as provided for by the ERTA legislation, brings the investment value for a wind farm down to $1814/kW(rated) subsequent to this time period.

Since the expected installed costs for the more mature small turbine wind farms are projected to be $2500/kW(rated) for 1985 operation, while the larger turbine wind farms are estimated to cost $3250/kW(rated) for 1985 operation, the investment value without any tax credits falls significantly short of these projected costs. This projected shortfall would seriously undermine the continued commercialization of this technology. The case for the solar thermal and photovoltaic systems, because of their current stages of development, is even more severe than the windfarm case illustrated above.

As a result, Polydyne, Inc. has evaluated the impact of the proposed energy tax credits under HR 1775 on the commercialization of selected wind, solar thermal and photovoltaic technologies. The results of these analyses are summarized in Tables 2 through 5 and in Figures 1 through 4. As can be seen from these results, the wind and solar technologies analyzed all have the expectation of achieving commercial viability under normal business risks and incentives without energy tax credits after the 1994 time period. However, the earlier installed systems costs associated with these technologies are substantially higher than the respective values computed under normal business investment conditions.

The effect of the proposed HR 1775 legislation is to increase the investment value to $2530/kW(rated) for a wind farm operational in 1985. Combining the effects of this proposed federal legislation with the proposed extension through 1986 of the California energy tax credits, the investment values in 1985 for the various technologies are increased to:

- $3072/kW(rated) for wind farms
- $3937/kW(rated) for solar thermal plants
- $3308/kW(peak) for photovoltaic plants

As can be seen from Tables 2 through 5 and Figures 1 through 4, these values are about equal to the corresponding expected installed costs during this time period.

Similarly, the investment values during the 1990 time period, reflecting the proposed HR 1775 legislation without any available state energy tax credits, fairly match the corresponding expected installed costs of the various wind and solar technologies considered in this analysis.

Therefore, the proposed tax incentives of HR 1775 "Renewable Energy Tax Credit Act of 1983", combined with the current and projected California energy tax credits, are found to be necessary to sustain the commercialization of these technologies during the period 1983 to 1994. The cases shown in **boldface** in Tables 2 through 5 indicate situations for a given year in which the investment value exceeds the projected (expected case scenario) installed costs.

The details of the financial analyses and a typical input and output for a wind farm case is shown in the Addendum. The projected costs under uncertainty for the wind, solar thermal and photovoltaic systems reflect the Polydyne, Inc. integrated market and cost analyses conducted for the Bonneville Power Administration (Bos and Weingart, 1982).

Potential Impacts on the U.S. Treasury

There has been concern expressed about the extent to which the federal government is financially exposed through these tax incentives. However, our preliminary analyses show the government exposure to be quite limited. The commercial diffusion of new

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All costs shown are in 1982 dollars, and represent the estimated overnight construction costs, without inclusion of either escalation or interest during construction or owner's costs. Costs are in dollars per kilowatt of rated capacity installed.

technologies typically follows a logistic diffusion or "S-shaped" curve. Figure 5 shows the potential market for wind energy systems in the United States through the year 2000. This potential market cannot be immediately realized because of the lead time required to build a viable wind energy industry. Consequently, this figure also shows potential penetration of this market under three different diffusion scenarios reflecting optimistic, expected and pessimistic conditions. As can be seen, during the initial commercialization, market penetration is slow, reflecting the complex market infrastructure and the associated time required to develop commercially mature advanced energy technologies.

This market penetration behavior is fully consistent with historical experience with a wide range of products and processes. It is specifically during this initial commercialization period that the federal and state tax incentives are essential to underwrite the aforementioned extraordinary risks. Once the diffusion process is well underway, the incentives can be significantly curtailed or subsequently terminated. By this time, the viable technologies will have achieved commercial beachheads, whereas the economically less viable concepts will have been eliminated from further consideration. Thus the marketplace will sort out the most viable technologies.

As a consequence of this diffusion process, the federal Treasury exposure is limited to the early phase associated with the commercialization of the technologies. During this period the number of systems benefitting from the tax incentives is relatively small. The benefits of the commercialization, in terms of potential tax revenues, will be substantial during the subsequent accelerated market penetration. During the commercial takeoff of these technologies, the costs will decrease with increased production, perceived levels of risk and associated investor-required rates of return will decline towards the levels characteristic of normal business investments. In addition, the economic value of the technologies will increase with increases in fuel prices and avoided costs. Hence the need for extraordinary risk underwriting will gradually disappear for commercially viable technologies.

During the subsequent phase, the tax revenues are projected to increase dramatically as a result of the combination of the enhanced values, lower projected costs and increased market penetration. This total integration of values, costs and market penetration as it affects the tax revenues warrants further detailed investigation.

Conclusions and Recommendations

Based upon our analysis to date we have concluded that there is a strong case for continued underwriting, especially at the federal level, of the extraordinary risks for solar and wind technologies through an extension and increase of the energy tax credits as proposed in HR 1775. This analysis also indicates the strong case for continuation of state tax credits, especially in states that are pivotal for commercialization of renewable energy systems. Polydyne, Inc. will continue to investigate the costs and benefits of these technologies to industry, government and to the nation as a whole.

Again, I would like to thank you for the opportunity to address this Committee on this important issue and I will be glad to share with you any additional information that we have developed in connection with this topic. In summary, the proposed legislation will have the desired effect of insuring the successful commercialization of economically viable renewable energy resources, a process which was initiated less than a decade ago. The benefits in terms of providing alternative energy resources which are nondepletable are projected to be very large, whereas the associated costs are relatively small.

References

P. B. Bos (1982). **Financing Alternatives and Incentives for Solar Thermal Central Receiver Systems.** Prepared for the Solar Energy Division, U.S. Department of Energy, San Francisco. Report #DOE/SF/11587-1.

P. B. Bos and J. M. Weingart (1983). **Solar Thermal, Photovoltaic and Wind Electric Power Systems Generic Cost Data Base.** Prepared for the Bonneville Power Administration, under subcontract to Raymond Kaiser Engineers.

TABLE 1. ENERGY TAX INCENTIVES AND WIND ENERGY SYSTEMS VALUE

Energy Tax Credit & Investment Scenario	Value (1982 $/kW)	Time Period
o Economic Recovery Tax Act (ERTA) $.08/kW-hr Avoided Cost 3%/Year Projected Avoided Cost Escalation	$ 3976	1981
o Decrease in Avoided Cost to $.06/kW-hr Lowered Price Escalation Forecast for Oil & Gas (0%/Year (real) to 1985, 2%/Year (real) thereafter)	$ 2957	1982/83
o Tax Equity and Fiscal Responsibility Act (TEFRA) Decreased Depreciation Base	$ 2712	1982/83
o Scheduled Termination of California State Energy Tax Credits by 12/31/83	$ 2053	12/31/83
o Scheduled Termination of Federal Energy Tax Credits	$ 1814	12/31/85

Notes:

- All values are for Wind Systems coming on line in 1985/6.
  Values are given in constant 1982 dollars per rated kilowatt of installed capacity.
- Investment Values were computed using the Polydyne, inc. Financial Analysis Model for Intermediary Financing. Model and Assumptions are discussed in Text and Attachments. (Assumed Risk Rate - 24% after taxes.)
- Table shows decreasing investment values for Wind Energy Systems with changes in Tax Policy, Fuel Price Projections and Avoided Costs.

TABLE 2. PROJECTED COSTS AND VALUES FOR SMALL WIND TURBINE FARMS

Year	Cost[2]	Value[3]	Energy Tax Credit[1]		Tax Incentive Policy Scenario[5]
	1982$/kW(Rated)		Federal	State[4]	
1985	2500	2053	15%	0%	Current
1986	2400	1814	0%	0%	Current
1986	2400	2530	25%	0%	HR 1775
1986	2400	3072	25%	25%	HR 1775 & State
1990	2050	2010	0%	0%	Current
1990	2050	2751	25%	0%	HR 1775
1994	1900	2993	25%	0%	HR 1775
1995	1850	2143	0%	0%	HR 1775/Current

Notes for Table 2 at end of tables.

TABLE 3. PROJECTED COSTS AND VALUES FOR LARGE WIND TURBINE FARMS

Year	Cost[2]	Value[3]	Energy Tax Credit[1]		Tax Incentive Policy Scenario[5]
	1982$/kW(Rated)		Federal	State[4]	
1985	3250	2053	15%	0%	Current
1986	3050	1814	0%	0%	Current
1986	3050	2530	25%	0%	HR 1775
1986	3050	3072	25%	25%	HR 1775 & State
1990	2500	2010	0%	0%	Current
1990	2500	2751	25%	0%	HR 1775
1995	2100	2143	0%	0%	HR 1775/Current

Notes for Table 3 at end of tables.

TABLE 4. PROJECTED COSTS AND VALUES FOR SOLAR THERMAL CENTRAL RECEIVER POWER PLANTS

Year	Cost[2]	Value[3]	Energy Tax Credit[1]		Tax Incentive Policy Scenario[5]
	1982$/kW(Rated)		Federal	State[4]	
1985/6	4250	2191	0%	0%	Current
1985/6	4250	3061	25%	0%	HR 1775
1985/6	4250	3937	25%	25%	HR 1775 & State
1990	3400	2400	0%	0%	Current
1990	3400	3412	25%	25%	HR 1775
1994	2800	3765	25%	0%	HR 1775
1995	2650	2632	0%	0%	HR 1775/Current

Notes for Table 4 at end of tables

TABLE 5. PROJECTED COSTS AND VALUES FOR PHOTOVOLTAIC POWER PLANTS

Year	Cost[2]	Value[3]	Energy Tax Credit[1]		Tax Incentive Policy Scenario[5]
	1982$/kW(Rated)		Federal	State[4]	
1985/6	5600	1851	0%	0%	Current
1985/6	5600	2572	25%	0%	HR 1775
1985/6	5600	3308	25%	25%	HR 1775 & State
1990	3000	2030	0%	0%	Current
1990	3000	2821	25%	0%	HR 1775
1990	3000	3620	25%	25%	HR 1775 & State
1994	2400	3087	25%	0%	HR 1775
1995	2200	2280	0%	0%	HR 1775/Current

Notes for Table 5 at end of tables.

Notes for Tables 2 thru 5

1. Also included in all of the financial calculations is the standard 10% Investment Tax Credit.

2. The costs shown are the estimated overnight construction costs in constant 1982 dollars per kilowatt of rated capacity.

3. The investment values were computed using the Polydyne, Inc. Financial Analysis Program for Intermediary financing and based on the financial and technical assumptions indicated in the text and in the addendum. No specific significance is attached to the values being shown to four significant figures: this is,however, the precise figure for the value under the financial conditions specified for the calculations.

4. The California State Energy Tax Credits are used for these calculations.

5. The current scenario assumes that the existing federal and state tax credits will expire as currently scheduled.

Note: The cases shown in boldface indicate conditions in which the investment value matches or exceeds the projected installed systems cost.

FIGURE 1: WINDFARM (20-100 MW)
SMALL WIND TURBINES - 50 kW(Rated)
VALUE VERSUS COST (Overnight Construction)
$/kW(Rated), 1982$

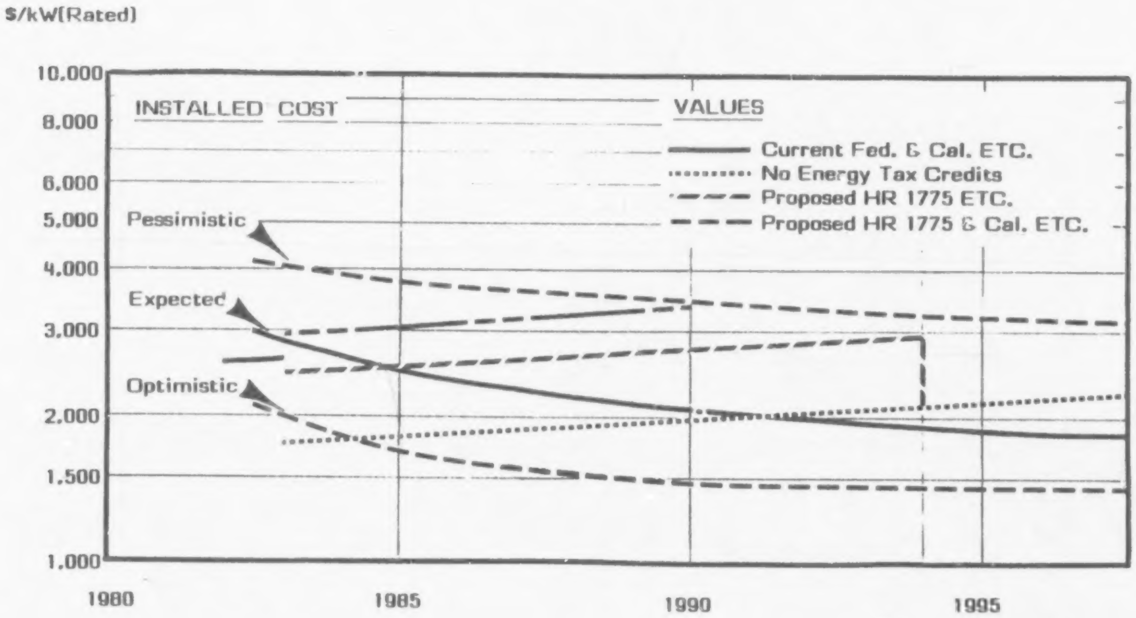

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FIGURE 2: WINDFARM (20-100 MW)
LARGE WIND TURBINES - 2.5-4.0 MW(Rated)
VALUE VERSUS COST (Overnight Construction)
$/kW(Rated), 1982$

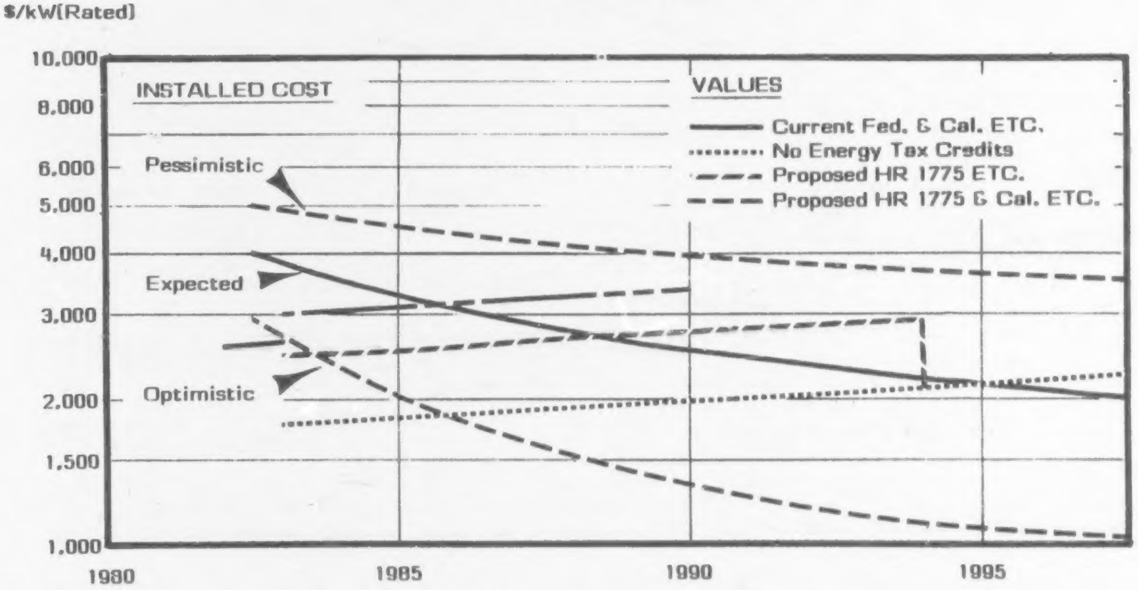

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FIGURE 3: SOLAR THERMAL PLANT (30-100 MW)
CENTRAL RECEIVER SYSTEM (Rankine Cycle - 3 Hrs. Storage)
VALUE VERSUS COST (Overnight Construction)
$/kW(Rated), 1982$

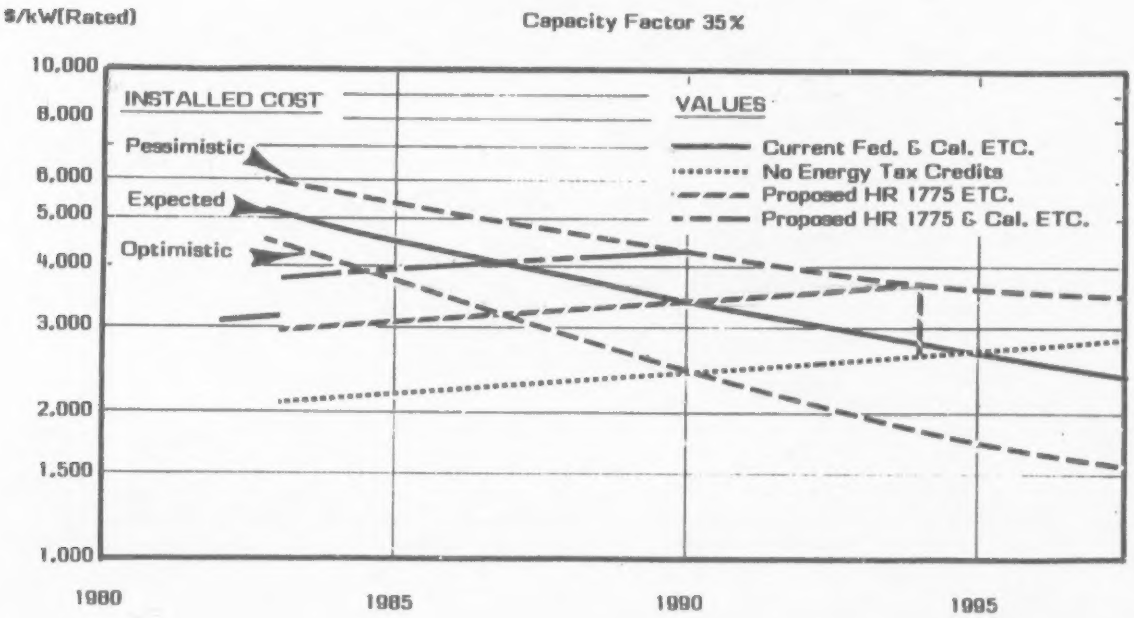

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FIGURE 4: PHOTOVOLTAIC PLANT (20-100 MW)
FLAT PLATE, TILTED ARRAYS (No Storage)
VALUE VERSUS COST (Overnight Construction)
$/kW(Pk), 1982$

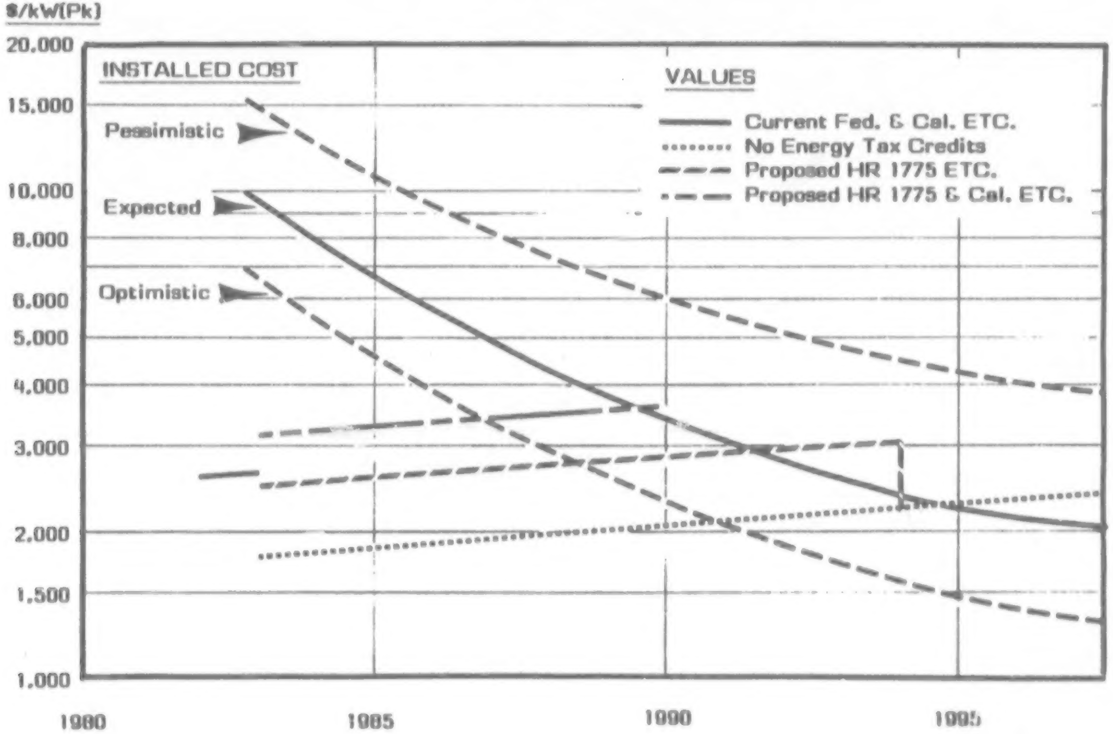

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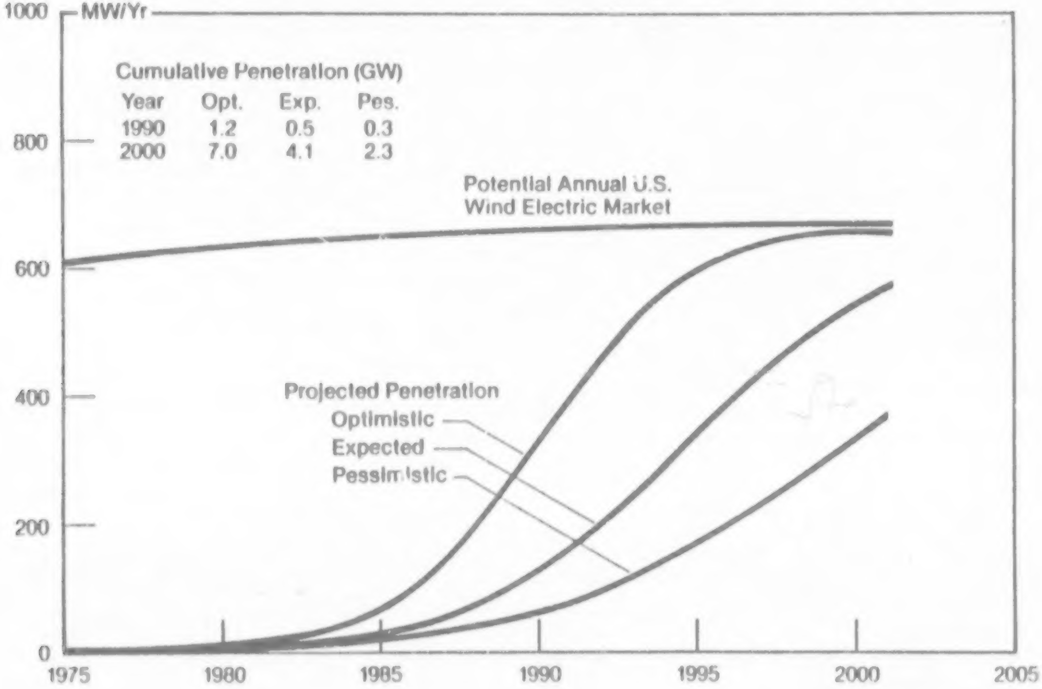
FIGURE 5

WIND ELECTRIC MARKET PENETRATION OF U.S. UTILITIES



Cumulative Penetration (GW)

Year	Opt.	Exp.	Pes.
1990	1.2	0.5	0.3
2000	7.0	4.1	2.3

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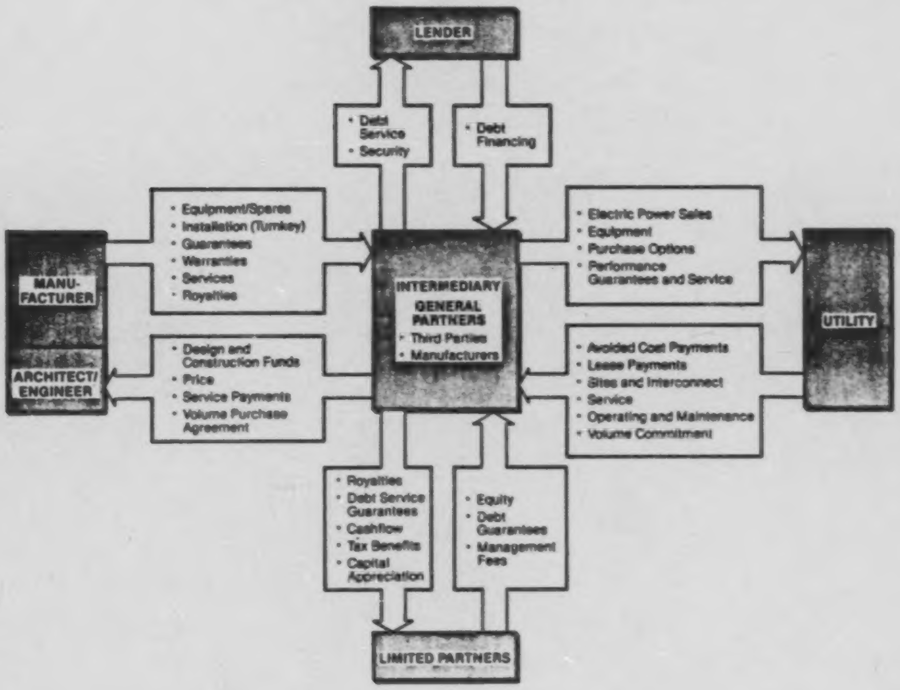
ADDENDUM

- Intermediary Financing Structure
- Polydyne, Inc. Financial Analysis Program Features
- Modified Internal Rate of Return Procedure
- Investor-Required Rate of Return Risk Parameters
- Typical Wind Farm Input and Output Data from Pro Forma Financial Analysis Program

FUEL CELL POWER PLANT
INTEGRATED COMMERCIALIZATION ANALYSIS

INTERMEDIARY FINANCING STRUCTURE


LENDER
• Debt Service
• Security
• Debt Financing
MANU-FACTURER
ARCHITECT/ ENGINEER
• Equipment/Spares
• Installation (Turnkey)
• Guarantees
• Warranties
• Services
• Royalties
• Design and Construction Funds
• Price
• Service Payments
• Volume Purchase Agreement
INTERMEDIARY
GENERAL PARTNERS
• Third Parties
• Manufacturers
• Electric Power Sales
• Equipment
• Purchase Options
• Performance Guarantees and Service
• Avoided Cost Payments
• Lease Payments
• Sites and Interconnect
• Service
• Operating and Maintenance
• Volume Commitment
UTILITY
• Royalties
• Debt Service Guarantees
• Cashflow
• Tax Benefits
• Capital Appreciation
• Equity
• Debt Guarantees
• Management Fees
LIMITED PARTNERS

POLYDYNE, INC. FINANCIAL ANALYSIS PROGRAM FEATURES

PLANT INVESTMENT SPECIFICATIONS

- YEAR OF OPERATION
- BASE YEAR DOLLAR INPUTS & CURRENT YEAR DOLLAR OUTPUTS
- CONSTRUCTION CASH FLOW SCHEDULE
- TOTAL PLANT INVESTMENT (INCLUDING AFUDC & SALES TAX)
- OWNERS COSTS (INCLUDING STARTUP COSTS)

COGENERATION MODEL

- ENERGY & CAPACITY SALES
- ENERGY & CAPACITY CREDITS
- THERMAL ENERGY CREDITS
- LEASE REVENUES & EXPENSES
- FUEL COSTS, HEAT RATE
- DISCRETE INTERVAL REVENUES & FUEL COST ESCALATION (3 DIFFERENT LEVELS POSSIBLE)
- FIXED & VARIABLE O & M COSTS

OTHER EXPENSES

- ROYALTIES
- INSURANCE

COMPLETE TAX TREATMENT

- PROPERTY TAXES
- MARGINAL FEDERAL & STATE TAX RATES
- FEDERAL & STATE ENERGY & INVESTMENT TAX CREDITS
- FEDERAL (ACRS) & STATE DEPRECIATION SCHEDULES
- SALE/SALVAGE VALUE
- FEDERAL & STATE CAPITAL GAINS TAX RATES

POLYDYNE, INC. FINANCIAL ANALYSIS PROGRAM FEATURES

FINANCING ARRANGEMENTS

- INTERMEDIARY FINANCING
  - MODIFIED INTERNAL RATE OF RETURN (MIRR) (RISK RATE/SAFE RATE)
  - LOAN SPECIFICATION (DEBT RATIO, LOAN TERM, INTEREST)
- CORPORATE FINANCING
  - COST OF CAPITAL

SEARCH CAPABILITIES

- MODIFIED INTERNAL RATE OF RETURN
- NET PRESENT VALUE

OUTPUTS

- CUMULATIVE CASH FLOWS
- MODIFIED INTERNAL RATE OF RETURN
- MODIFIED NET PRESENT VALUE
- CORPORATE NET PRESENT VALUE
- KEY PARAMETERS

FUEL CELL POWER PLANT
INTEGRATED COMMERCIALIZATION ANALYSIS

MODIFIED INTERNAL RATE OF RETURN

- POSITIVE CASH FLOWS ARE REINVESTED AT SPECIFIED **RISK RATE**
- **RISK RATE** IS REQUIRED RATE OF RETURN ON INVESTMENTS OF SIMILAR RISK (AFTER TAXES)
- NEGATIVE CASH FLOWS ARE DISCOUNTED AT A **SAFE RATE**
- **SAFE RATE** REFLECTS THE AFTER-TAX RATES OF RETURN ON LIQUID. LOW-RISK INVESTMENTS (EG. GOVERNMENT SECURITIES)
- SAFE RATE DISCOUNTING IS EQUIVALENT TO ESTABLISHING A SINKING FUND (SATISFIES LOAN INTEREST COVERAGE REQUIREMENT BY LENDER)
- MODIFIED INTERNAL RATE OF RETURN FOR PROJECT **MUST BE GREATER THAN OR EQUAL TO THE REQUIRED RISK RATE**

FUEL CELL POWER PLANT
INTEGRATED COMMERCIALIZATION ANALYSIS

- REQUIRED RATE OF RETURN - FUNCTION OF AGGREGATE RISK

TYPE OF RISK	EXAMPLE
TECHNICAL	O COMPONENT LIFETIME/FAILURES O AVAILABILITY & RELIABILITY
ECONOMIC	O FUEL PRICES & AVOIDED COSTS O COMPETITION FROM ALTERNATIVE TECHNOLOGIES
FINANCIAL	O COST UNCERTAINTIES O FINANCIAL ARRANGEMENTS O LEVERAGE O DEBT COVERAGE O WARRANTIES & GUARANTEES O OPERATING COSTS
INSTITUTIONAL	O PURPA O AIR QUALITY (EMISSIONS) CREDITS O UTILITY INDUSTRY ACCEPTANCE O SOCIAL ACCEPTANCE

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PROFORMA FINANCIAL ANALYSIS    INPUT DATA
PROJECT DESCRIPTION:     WINDFARM                           Project Period           15 years
---------------------------------------------------------------------------------------------------
System Size                  30MW                           Financing Type:      Intermediate
Operation Year               1985                           Risk (Equity) Rate      24.00%
Base Year Dollar             1982                           Safe Rate of Return      5.00%
Inflation                    6.00%                          Debt Ratio                75%
Plant Cost                   2531$B/kW                      Loan Term                 15Yrs
Interconnect Cost              0$B/kW                       Loan Interest           15.00%
Construction Interest       15.00%                          Cost of Capital         12.50%
Construction Period            2Years
Construction Cash Flows                  -5        -4        -3          -2        -1       0
  Percent                                 0         0         0           0        50      50
Owner's Costs                5.00%                          Investment Tax Credit
Capital Cost Escalation      6.00%                            Federal         10 in yr0         0 in yr1
Capacity Factor             30.00%                hrs         State            0 in yr0         0 in yr1
Energy Sales               100.00%                          Energy Tax Credit
Avoided Costs                .068$B/kWh                       Federal         25 in yr0         0 in yr1
Avoided Cost Escalation                                       State            0 in yr0         0 in yr1
  Year Interval              1980     1985     1990
  Percent Escalation         6.00     8.12     8.12
Contract Capacity             30MW                          Depreciation Period
Capacity Contract Price       60$B/kW-yr                      Federal          5 Years
Capacity Cost Escalation     6.00%                            State           10 Years
Energy Charge                 .00      .00$B/kWh            Depreciation Base
Energy Charge Escalation                                      Federal      82.50%
  Year Interval              1980     1985     1990           State       100.00%
  Percent Escalation         6.00     8.12     8.12
Capacity Charge                0$B/kW-yr                    Depreciation Schedules  (%)
Cap. Charge Escalation       6.00%                                    Year  Federal    State
Lease Revenues                .00$1000B/yr                               0       15        0
Lease Revenue Escalation     6.00%                                       1       22       18
Fuel Price                    .00$B/MBTU                                 2       21       16
Fuel Price Escalation                                                    3       21       15
  Year Interval              1980     1985     1990                      4       21       13
  Percent Escalation         6.00     8.12     8.12                      5        0       11
Intermediate Heat Rate           BTU/kWh                                 6        0        9
Fixed O&M                   25.00$B/kW-yr                                7        0        7
Variable O&M                     0MillsB/kWh                             8        0        5
O&M Escalation               6.00%                                       9        0        4
Management Fees             25.00$1000C/yr                              10        0        2
Syndication Fee             10.00%                                      11        0        0
Lease Expenses                .00$1000B/yr                              12        0        0
Lease Escalation             6.00%                                      13        0        0
Royalties                     .00% of Rev                               14        0        0
Sales Tax                    6.00%                                      15        0        0
Insurance Rate               1.00%                          Sales/Salvage Value       400$B/kW
Property Tax Rate            1.00%                          Capital Gains Tax     Fed.      State
Marginal Tax Rates                                             Percent                20          6
  Federal                   50.00%                          Discount Rates        Fed.      State
  State                     11.00%                             Percent                10          8
```

PROFORMA FINANCIAL ANALYSIS (\$1000 Current)

INVESTMENT	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Actual Constr. Costs	0	0	0	0	42654	87866					
AFUDC	0	0	0	0	0	6398					
Sales Tax	0	0	0	0	2559	5272					
Total Plant Investment	0	0	0	0	45213	99536					
Owners Costs						4977					
Total Capital Requirement	0	0	0	0	45213	104513					
REVENUES AND SAVINGS											
Energy Sales							6091	6586	7121	7699	8324
Capacity Sales							2272	2409	2553	2707	2869
Energy Savings							0	0	0	0	0
Capacity Savings							0	0	0	0	0
Lease Revenues							0	0	0	0	0
Total Revenues							8364	8995	9674	10406	11193
OPERATING COSTS											
Fuel Costs							0	0	0	0	0
Operating & Maintenance							947	1004	1064	1128	1195
Lease Exp/Royalties							0	0	0	0	0
Insurance Costs							995	995	995	995	995
Mgmt Fees/Syn Fees						9954	25	25	25	25	25
Property Taxes							995	995	995	995	995
Interest Expenses							11198	10963	10692	10381	10023
Operating Income						-9954	-5797	-4987	-4097	-3118	-2041
Depreciation (State)						0	18095	16284	14483	12671	10859
Earnings Before Taxes						-9954	-23892	-21271	-18580	-15789	-12900
State Income Taxes						-1095	-2628	-2340	-2044	-1737	-1419
State Tax Credits						0	0				
Net State Income Taxes						-1095	-2628	-2340	-2044	-1737	-1419
ACRS						12318	18066	17245	17245	17245	0
Net State Income Taxes						-1095	-2628	-2340	-2044	-1737	-1419
Earnings Before Taxes						-21176	-21234	-19892	-19298	-18626	-622
Federal Income Taxes						-10588	-10617	-9946	-9649	-9313	-311
Federal Tax Credits						34838	0				
Net Federal Income Taxes						-45426	-10617	-9946	-9649	-9313	-311
Net Income After Taxes						24250	-10617	-9946	-9649	-9313	-311
CASH FLOWS											
Net Income After Taxes						24250	-10617	-9946	-9649	-9313	-311
ACRS						12318	18066	17245	17245	17245	0
Equity/OC Payments						29861					
Payments to Principal							1569	1804	2075	2386	2744
Net Cash Flows						6706	5880	5494	5521	5545	-3055

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
9000	9731	10521	11375	12299	13298	14378	15545	16807	18172	
3041	3224	3417	3622	3839	4070	4314	4573	4847	5138	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
12041	12955	13938	14997	16138	17367	18691	20118	21654	23310	36307(Sale)
0	0	0	0	0	0	0	0	0	0	
1267	1343	1424	1509	1600	1696	1797	1905	2020	2141	
0	0	0	0	0	0	0	0	0	0	
995	995	995	995	995	995	995	995	995	995	
25	25	25	25	25	25	25	25	25	25	
995	995	995	995	995	995	995	995	995	995	
9611	9138	8593	7967	7247	6419	5467	4372	3113	1665	
-853	458	1905	3505	5276	7237	9411	11824	14506	17488	36307
9048	7236	5425	3623	1812	0	0	0	0	0	
-9901	-6778	-3519	-118	3464	7237	9411	11824	14506	17488	36307
-1089	-746	-387	-13	381	796	1035	1301	1596	1924	1997
-1089	-746	-387	-13	381	796	1035	1301	1596	1924	1997
0	0	0	0	0	0	0	0	0	0	
-1089	-746	-387	-13	381	796	1035	1301	1596	1924	1997
236	1204	2292	3518	4895	6441	8376	10524	12910	15565	34310
118	602	1146	1759	2447	3220	4188	5262	6455	7782	6862
118	602	1146	1759	2447	3220	4188	5262	6455	7782	6862
118	602	1146	1759	2447	3220	4188	5262	6455	7782	27448
118	602	1146	1759	2447	3220	4188	5262	6455	7782	27448
0	0	0	0	0	0	0	0	0	0	
3156	3629	4173	4800	5519	6347	7299	8394	9654	11102	
-3038	-3027	-3027	-3040	-3072	-3127	-3112	-3133	-3198	-3319	27448

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--------------------------------------------------------------------------------------------------------------
Net Cash Flows                                                    6706     5880     5494     5521     5545    -3055

                                                                  1985     1986     1987     1988     1989     1990
Cumulative Cash Flows                                             6706    12586    18080    23601    29146    26092
Cumulative State Taxes                                            4177     2544     1200      151     -590    -1014
Cumulative Federal Taxes                                        -45426   -56043   -65989   -75630   -84951   -85262

PERFORMANCE INDICATORS
Positive C.F.                                                     6706     5880     5494     5521     5545        0
Negative Cash Flow                                                   0        0        0        0        0    -3055
Modified Internal Rate of Return                                24.00%
FV of Positive CF                                               660499
PV of Negative CF                                               -21141
Modified Net Present Value                                           0
NPV (CF,Corporate)                                                6706    11933    16274    20151    23613    21918
NPV (Federal Taxes)                                             -45426   -55078   -63298   -70547   -76908   -77101
NPV (State Taxes)                                                 4177     2665     1513      680      135     -153

                     COMPUTED PARAMETERS ($1000 Current)
--------------------------------------------------------------------------------------------------------------
Total Plant Investment              99536      Fed. Inv. Tax Credit               9954
Federal ACRS Base                   82118      Fed. Energy Tax Credit            24884
State Depr. Base                    99536      State Inv. Tax Credit                 0
Equity Amount                       29061      State Energy Tax Credit               0
Loan Amount                         74652      Energy Output (1000kWh/yr)        78840
Loan Payment                        12767      Sales/Salvage Value               36307               12100C/KW

Principal Remaining                                               74652    73083    71279    69204    66810    64074
-----------------------------------------------------------------------------------------------
   -3038    -3027    -3027    -3040    -3072    -3127    -3112    -3133    -3198    -3319    27448

    1991     1992     1993     1994     1995     1996     1997     1998     1999     2000     2001
   23054    20027    16999    13959    10887     7760     4648     1516    -1683    -5002    22446
   -1107     -858     -249      733     2109     3901     5931     8227    10818    13737    15734
  -85144   -84542   -83396   -81637   -79189   -75969   -71781   -66519   -60064   -52282   -45420


       0        0        0        0        0        0        0        0        0        0    27448
   -3038    -3027    -3027    -3040    -3072    -3127    -3112    -3133    -3198    -3319        0



   20420    19092    17912    16859    15913    15057    14300    13622    13008    12440    16610
  -77034   -76726   -76191   -75445   -74501   -73373   -72038   -70514   -68814   -66951   -65458
    -212      -66      262      754     1391     2160     2966     3810     4692     5613     6195

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   60918    57289    53115    48316    42796    36449    29150    20755    11102        0        0
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PETER B. BOS, President

Mr. Bos is the founder and President of Polydyne, Inc. He has over twenty years of management experience with various energy technology companies. Mr. Bos has extensive experience in the interdisciplinary synthesis of energy systems to include technology development and transfer, market analysis and penetration, energy investment and tax incentive analysis, utility interfacing and regulatory considerations, and private and public sector interaction.

Accomplishments include management of major demonstration projects throughout the United States and authorship of numerous articles and reports on the status of and prospects for advanced energy technologies. He has participated in many advisory committees and workshops and has contributed to significant program decisions on a national level. As a consequence, Mr. Bos is widely known throughout the utility and vendor industries, the U.S. Department of Energy and associated laboratories and in the energy community in general.

Prior to Polydyne, Inc., Mr. Bos was Director of the Department for New Energy Resources Deviopment at the Electric Power Research Institute. In this position he was responsible for planning, direction, and control of the utility-sponsored national solar, geothermal, and fusion programs with a five-year budget of $60 million.

Mr. Bos holds an MBA degree from the Graduate School of Business Administration at the University of California, Los Angeles, and an Engineering degree from the Massachusetts Institute of Technology.

Mr. FUQUA. Thank you, sir.

Mr. Schell.

Mr. SCHELL. Mr. Chairman, thank you very much for the opportunity to testify before this subcommittee today on the effects of the various tax incentives on the commercialization of new energy technologies.

I have prepared a written statement and I will try to summarize the key points from that statement in my remarks today. I will also limit my comments to the impact of energy and tax incentives on major synthetic fuel projects such as shale projects or goal gasification projects. I will limit them because of my background in this area.

Kidder, Peabody, the firm that I work for as a vice president, has had a specialized financing group dedicated to helping the development of synthetic fuel projects through their financing stage.

This group does the financial and economic analysis to prove to the private-sector investors the worth of putting a dollar today at risk in an investment in a major project in return for capturing adequate returns for that risk in the out-years.

So we are thoroughly involved in the financing of these projects at this stage, as you might imagine, particularly with regard to two projects that are currently before the Synthetic Fuels Corporation in negotiation of financial assistance requests.

The parameters of a major synthetic fuel project such as a shale project or a coal gasification project are long term by nature. Let me explain that for a minute.

It takes about 4 to 5 years to permit a facility, acquire your resources, do the financing and construct the facility. It takes another couple of years when the project is operating at best at breakeven, more typically at a loss as it moves toward full capacity utilization during the startup phase.

So an investor today investing a dollar in a synthetic fuel project does not plan to see any return for that dollar investment for 6 to 7 years down the road. So it is a long-term process of investment.

It is absolutely critical that in making that investment decision, the investor has a sense that there will be consistent policy from government, both at the Federal and State level, with regard to that investment since he has to wait so long for the return of his dollar investment. This particularly holds true in the area of tax incentives from the Federal Government.

I would like to look at two things primarily: the effects of recent tax initiatives on the commercialization of synthetic fuel plants; and also, as suggested in your letter of invitation to make oral comments today, the level and the expiration date for tax incentives.

First, let me turn to the Tax Equity and Fiscal Responsibility Act, or the Tax Act of 1982, which, in my opinion, was very damaging on its face to this consistency that I say was so important in the development of synthetic fuel projects.

There were four provisions, section 204 through section 207, which were very damaging to the economic analysis that we do in support of financing synthetic fuel projects. Even more important, in some respects, is the interpretation that is left up to the Internal Revenue Service of some of the provisions of that act.

For instance, let me just highlight one: the definition of personal versus real property for the calculation of capitalization versus expensing of interest costs during the construction phase. That one provision eroded the returns to the sponsors of the synthetic fuel projects that we are working for, and others, by a factor of 18- to 25-percent when coupled with the other provisions which had a more minor impact than that.

I think the way to solve this problem is to exclude, near term, those projects, those synthetic fuel projects which are currently under development and are going to prove to this Nation that we can realize energy independence when it is economically viable to do so.

Excluding those near-term projects from sections 204 through 207 would be very helpful in making those projects go forward. I think you all understand, as I do, that many of the projects that have had millions and millions of dollars of private-sector investment already put into them are still in jeopardy of being cancelled, given the current economic climate.

The second point that I would like to make in this area is the expiration of the affirmative commitment rules also has a double-jeopardy effect on the synthetic fuels industry for the same reasons. Now plants, plants that are currently being considered in the development stage, certainly will not qualify for the energy tax credit, which is a very important component in our economic analysis, proving to the private sector that investment in these projects is worthwhile.

Second, the more mature projects, which believe they have met the affirmative commitment rules as of the date of their termination, December 31, 1982, still must face the risk that there is a contrary ruling than what they are expecting from the Internal Revenue Service because of the general nature of the affirmative commitment rules as stated in the Energy Tax Act of 1978.

Certainly H.R. 3283 and S. 1396 will be very, very helpful in solving this problem with regard to energy tax credits, not only for the projects that are currently under development that have millions already invested on the basis that those tax credits would be available, but also on the further development of projects that none of us have heard of even yet.

Next, I would like to talk about the level of tax credits and the expiration date, asking the question, what is the proper level? We now have a 10 percent energy tax credit for these kinds of projects, synthetic fuel projects, and I certainly agree with the general statement that the level should be defined as the minimum necessary to stimulate development and production of synthetic fuels. It should be no higher than that.

It should certainly not be influenced, as I go into my written statement but will not dwell on here, by revenue loss arguments from Treasury since my analysis, and I think the analyses of others who you will hear from or have heard from, suggest quite the contrary, that there is no revenue loss, not even in the near-term years. Certainly there is a great revenue gain in the outyears from encouraging the development of synthetic fuel projects that, without energy tax credits, may not go forward.

The best solution is the one, I think, in determining the level of assistance suggested by S. 1396 for energy tax credits, that being not to change the 10-percent credit, simply to expand the credit in two ways. First is to expand the equipment that is vital to a synthetic fuel project that qualifies for the credit. For instance, in a synthetic fuel project that costs $1.3 billion to build, under current definitions, if they are not expanded, only about $400 million of the $1.3 billion, or about 40 percent, a little less than 40 percent, qualifies for the energy tax credit.

Expanding the definition in the case of a shale project to include the hydro treater makes all the sense in the world since it is a vital part of that plant. Not included in S. 1396, but in support of the statements made earlier by Dr. Papay, I am also a firm believer that the credit should be expanded to include utility company investment in synthetic fuel projects.

Utilities, in many cases, are very large customers and should be large investors in synthetic fuel projects since they depend on the very thing that we are trying to accomplish with the synthetic fuel program, which is reduction in the importation of oil from offshore.

Again, I will reiterate, the biggest need that we have in financing the synthetic fuels industry today, or any renewable to tentative energy program is consistency in as many levels as we can to reduce the risk of those investments. Consistency is certainly needed in the area of energy tax incentives.

I think the expansion and extension of the energy tax credit is in keeping with that consistency.

Thank you, Mr. Chairman. I will be happy to answer any questions at the end of the panel.

[The prepared statement of Mr. Schell follows:]

TESTIMONY ON

TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

PRESENTED BY
JOSEPH M. SCHELL
VICE PRESIDENT AND DIRECTOR
KIDDER, PEABODY & CO. INCORPORATED
NEW YORK, NEW YORK

TO

U. S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

WASHINGTON, D. C.

JULY 21, 1983

Mr. Chairman, members of the Subcommittee, my name is Joseph M. Schell. I am a Vice President and Director of Kidder, Peabody & Co. Incorporated, a large investment banking and brokerage firm headquartered in New York City. During my ten years at Kidder, Peabody, I have concentrated on energy sector financing, with a specific focus during the last 2½ years on alternative energy as Director of our Synfuels Group.

I appreciate the opportunity to present to the Subcommittee my views on the effects of various energy tax incentives on the development and commercialization of energy technologies. We in the financial community are encouraged by the recent introduction in both the House of Representatives and the Senate of legislation designed to broaden and extend the availability of energy tax credits. These Bills, including S. 1396 and H.R. 3283, in my opinion extend to only the most promising technologies an opportunity to attract sufficient levels of private sector investment to develop an alternative energy industry in this decade.

My specific interests are with H.R. 3283, as introduced by Representative Jenkins and S. 1396, as introduced by Senator Domenici. These bills extend the affirmative commitment deadline, as well as expand coverage of the energy tax credit to include ancillary synthetic fuel production equipment, shale oil processing equipment, and tar sands projects. I will limit my discussions to these Bills, as I feel most qualified to address them.

By way of background, let me take a minute to explain Kidder, Peabody's role in the synthetic fuel industry. In 1980, Kidder, Peabody organized a Synfuels Group to provide in-depth financial services to the developing synthetic fuels industry. The Synfuels Group's responsibilities touch on each phase of a successful synthetic fuels project financing--the initial conception, the economic and financial analyses, the development of an optimum financing program, the identification and solicitation of equity sponsors, the negotiation of terms of any financial assistance made available through U.S. Federal Government programs and the structuring and sale of equity and debt securities. In addition to our other assignments, the Synfuels Group is currently acting as financial advisor to two synthetic fuels projects—one coal-based and the other shale oil—which have recently entered into negotiations with the U. S. Synthetic Fuels Corporation for financial assistance.

There are two principal reasons why H.R. 3283 and S. 1396 are vital to the commercial development of a synthetic fuels industry in the United States.

First, energy tax credits are critical to the economic analysis on which the private sector bases its investment decisions on synthetic fuels production facilities. In assessing a synthetic fuel project's economic viability, extensive financial analysis is required. This analysis incorporates the financial impact of such incentives as loan guarantees, price guarantees, investment and business energy tax credits, as well as other applicable provisions within the U.S. Tax Code. The purposes of the analysis is to justify to the private sponsors that the projected returns warrant the huge capital investments that are required.

To be sure, the Federal Government has provided a variety of financial incentives for the construction and operation of synthetic fuel production equipment. These incentives take many forms and serve any of a number of separate and distinct purposes from the viewpoint of lenders and equity investors.

The purposes of these incentives are perhaps best viewed by reference to the factors which an investor in synthetic fuel projects must consider. First, one must consider the basic economics of a project—whether, if everything goes as expected, it will be profitable. Profitability is typically defined by the private sector as an adequate cash return over time on the original investment. In cases where the projected returns appear insufficient to encourage private investment in projects having national security implications, the Federal Government may (i) improve the investment fundamentals by making grants or providing tax credits during the construction period thereby reducing the investment required and raising the return and (ii) reduce the risk through loan or price guarantees thereby making the projected returns more acceptable.

Fortunately, the Congress has shown foresight in its efforts to encourage private sector investment in alternative energy projects by providing various forms of incentives. The intent of Congress was to provide incentives, to be used singularly or in combination, to assist the business community in the accelerated development of a new industry, but only to the minimum extent necessary to induce private investment.

Unfortunately, we have seen in the last year that even with the availability of these credits and other forms of Federal financial incentives, many synthetic fuel projects were cancelled as a result of a lack of private sector investment. Therefore, it is difficult to draw a conclusion that suggests that business energy tax credits are not needed to encourage such investment. To the contrary, as envisioned in H.R. 3283 and S. 1396, an expansion of these credits is required to encourage existing projects to stay the course.

The second reason H.R. 3283 and S. 1396 are vital is that passage of this legislation will demonstrate to project sponsors the existence of continued Congressional intent to support alternative energy production. The development of a commercial synthetic fuels industry is a long-term proposition. Acquiring a resource position, gaining all necessary environmental clearances, arranging the financing and constructing a plant is a process which takes many years. In addition, the private sector is absolutely dependent on consistent governmental policies throughout the long development process because changes which appear only minor in the overall scheme of things can have catastrophic effects on a new-born industry. While it is admittedly difficult to document, it is my opinion that the recent shrinkage in the synthetic fuels industry can be partially attributed to the sense among certain private sector concerns that the U. S. Government has been a fickle partner. The Federal Government incentives embodied in the Energy Security Act and The Economic Recovery Tax Act of 1981 were undermined by well-publicized misgivings about synthetic fuel development among certain members of the Administration and Congress and by certain provisions of The Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). Passage of H.R. 3283 and S. 1396, in my opinion, will have a significant positive impact on investors which may counterbalance the decidedly negative impacts of certain provisions of TEFRA and recent legislative initiatives to curtail the funding authority of the U.S. Synthetic Fuels Corporation.

The revenue impact to the U. S. Treasury of ETC is actually positive assuming that the availability of ETC is critical to the original investment decision.

Any analysis of a continuation and/or expansion of business energy tax credits must examine the revenue impact on the U. S. Treasury of providing such credits. While there is a "revenue loss" to the Treasury to the extent that project sponsors are able to use the credits to offset taxes otherwise payable, we must also consider the revenue gain to the Treasury flowing from income taxes paid by construction and operating personnel as well as tax receipts generated by the project itself.

To highlight my belief that the ETC will actually have a positive revenue impact, I will use a simple example of a typical western U.S. shale oil project.

A typical 10,000 - 15,000 barrel per day shale oil project will require approximately 3 years to construct and will cost in excess of $1.3 billion when completed. Under existing law, the equity sponsors receive energy tax credits of approximately $50 million in this period, or approximately $17 million per year, assuming that the project met the affirmative commitment rules by January 1, 1983. During this three year period, average annual income taxes paid by construction workers would be approximately $17 million per year. Therefore, the U. S. Treasury recovers its "investment" in the project in the form of energy tax credits in each year of construction as a result of federal income taxes paid by workers (see Exhibit I). Further, during the project's operations, the U. S. Treasury collects approximately $2.3 billion in tax receipts, as described below.

An alternative way of analyzing the revenue impact is to view the U. S. Government as an "investor" in a synthetic fuels project. Its investment is equivalent to revenues foregone due to the utilization of ITC and ETC by the corporate sponsors and its return is income taxes paid by the project's labor force during both the construction and operating periods and by the project itself on its taxable income generated over the life of the project.

TREASURY'S INVESTMENT

ITC	$ 90 million
ETC	$ 50 million
TOTAL:	$ 140 million

TREASURY'S RETURN

Income taxes payable by construction labor	$ 50 million
Income taxes payable by operating labor	$1,650 million
Income taxes payable by Project	$ 700 million
TOTAL:	$2,400 million

With a seventeen-fold recovery of its investment, the returns to the U. S. Treasury are very handsome indeed. Naturally, this example is oversimplified in order that the conclusion not get lost in excessive arithmetic. In the near-term, there is no revenue impact since ETC credits taken on a progress expenditure basis during the construction period would be directly offset by estimated income taxes payable by the construction labor force. In the out years, income taxes payable by the operating labor force and the project itself exceed even the most optimistic dreams of the supply-side advocate. Of course, this all assumes that the availability of tax credits is integral to the decision by the private sector to proceed with the project. My somewhat frustrating experience in raising capital for synthetic fuels projects over the last several years strongly suggests that every component of the return equation is absolutely critical.

The impact of The Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) on synthetic fuel project financing.

Over the last two years, a limited number of synthetic fuels project sponsors have spent a significant amount of capital on up-front development of synfuel projects on the basis that the economic returns to the project sponsors would justify the projected expenditures. As stated earlier, the economic returns that were projected were highly dependent on a consistent application of the then-applicable tax laws. Further, the economic returns available to the private sector sponsors of these projects are highly dependent on future energy prices. Several years ago, energy economists were uniformly predicting 2% - 3% real growth in energy prices. Now there is no uniformity in energy price forecasting other than that there have been significant downward revisions for at least the rest of this decade. These forecasts, coupled with recent reductions in the tax benefits made available to promote capital investment in energy projects, has complicated the job of attracting sufficient private sector investment in synthetic fuels production facilities.

The uncertainty now attached to the assumption of consistent federal tax treatment, as a result of the passage of TEFRA, merely compounds the other technical and market uncertainties of a synthetic fuels project, thereby increasing the return requirements of the few industrial sponsors willing to take the long-term perspective necessary for the establishment of a domestic synthetic fuels industry.

Specifically, TEFRA adversely impacts the economic returns of synthetic fuels investment through the following four provisions:

1. Section 204 — This section provides that 15% of the cost of mineral exploration and development incurred in any one year must now be capitalized, rather than be expensed.

2. Section 205 — This section provides for a depreciation basis reduction to reflect 50% of the investment tax credit and the business energy tax credit taken.

3. Section 206 — This section repeals the ACRS treatment in 1985 and 1986 which was specified in the Economic Recovery Tax Act of 1981.

4. Section 207 — This section provides for the capitalization of construction period interest and taxes on real property investments.

To provide a specific example of the impact of these TEFRA provisions, Kidder, Peabody completed several financial analyses last December of typical synthetic fuel projects, on a pre-TEFRA and post-TEFRA basis. In summary, the returns fell between 18% and 25% on these projects. More importantly, the returns fell well below those necessary to retain the interest of existing sponsors and to attract additional sponsors.

Thus, many synthetic fuel projects currently under consideration by the SFC will require larger amounts of financial assistance in the form of loan and price guarantees to offset the negative impact of TEFRA. It is my view that the incentives provided under the U. S. Tax Code prior to the passage of TEFRA were a far greater economic stimulus than additional amounts of U. S. Synthetic Fuels Corporation loan and price guarantees.

It should be clear, given the slow progress in the development of synthetic fuels projects in this country, that there is little incremental revenue gained by the U. S. Treasury as a result of subjecting the few remaining synthetic fuels projects to these provisions of TEFRA. It should be equally clear that the cumulative effect of Sections 204, 205, 206 and 207 of TEFRA, adopted at a time of eroding oil prices and slow economic growth, has impeded the establishment of a domestic synthetic fuels industry in the near-term and thereby is inconsistent with the national security considerations which provide the foundation of the Energy Security Act.

Consequently, Kidder, Peabody strongly recommends that the necessary legislative steps be taken to exclude near-term synthetic fuels production facilities, in which significant development expenditures had been made prior to the enactment of TEFRA, from Sections 204, 205, 206 and 207 of that Act.

U. S. Federal Government policy options which the Subcommittee may consider in order to stimulate the development of synthetic fuels technology:

At this time of plentiful supplies of motor fuel at reduced prices relative to price trends in the last three years, U. S. automakers are finding a greater demand for larger and less fuel efficient automobiles. If this demand continues, it may impact their ability to meet the fuel economy standards under the Energy Policy and Conservation Act and require substantial penalty payments from an industry which can ill-afford them. Therefore, in an effort to find a solution to this problem as well as to promote the use of synthetic fuels such as methanol produced from coal, the Congress may wish to consider a higher mileage credit for these automobiles designed to operate on methanol enhanced fuels in the computation of Corporate Average Fuel Economy Standards (CAFE). Discussions of this option within this Subcommittee, as well as within other Committees and Subcommittees of jurisdiction, would, at least, focus attention on an incentive which has no budgetary impact and aids the domestic auto manufacturers whose participation is integral to the full realization of our synthetic fuels potential.

Kidder, Peabody & Co.
Incorporated

JOSEPH M. SCHELL

Vice President and Director
Kidder, Peabody & Co. Incorporated

Responsibilities

Mr. Schell is a Vice President and Director of Kidder, Peabody & Co. Incorporated and the Manager of the SynFuels Group. He is responsible for the efforts of several individuals working exclusively in the alternative energy area and for coordinating the firm's various departments in identifying and implementing creative financing techniques for clients contemplating participation in alternative energy projects.

Experience

Mr. Schell joined Kidder, Peabody in the Corporate Finance Department in 1973. In 1976 he moved to Kidder's Utility Finance Department where he was primarily involved in raising new capital for the electric and gas industries. He has participated in utility and regulatory seminars as a guest lecturer and has testified before state and federal regulatory commissions. He has also participated as a guest speaker in numerous conferences relative to financing the emerging synfuels industry and has testified before various Congressional committees on energy tax matters.

Education

M.B.A.	Harvard Business School, 1973
B.A.	Amherst College, 1968

Mr. Fuqua. Thank you very much, Mr. Schell.

Mr. Babcock.

Mr. Babcock. Thank you, Mr. Chairman.

I appreciate the opportunity to present an overview of our recently completed study analysis of Federal energy tax credits to the subcommittee and would like to offer a complete copy of our final report for the record.

At the request of the Solar Energy Industries Association, the Renewable Energy Institute and the American Wind Energy Association, Booz, Allen & Hamilton recently performed a study of the impacts of expanded solar/wind tax credits.

We analyzed the impact on the solar industry and on Treasury revenues in the 1985–1990 time frame. The solar wind applications that were analyzed are the: wind-electric systems, thermal electric, and photovoltaics in the electric utility market; solar thermal in the industrial market; and solar thermal and wind-electric in the residential market.

Tax credit impacts were estimated by combining analyses of economic attractiveness of each system, given current energy and financing costs, with information on the current status of each technology and estimates of future market potential.

The major conclusion of our study is that the availability of solar/wind tax credits beyond 1985 is essential to maintain and nurture the current solar industry.

Furthermore, the long term direct cost to the Treasury of these tax credits could be largely offset by the increased tax revenues that will result from the decrease in conventional fuel tax deductions available to solar system owners in the business sector.

Without Federal and State energy tax credits, or unexpectedly large increases in the cost of conventional fuels, solar technologies will remain uncompetitive except in certain small niche markets, the early adopters and remote applications, for example. Industry growth will be minimal at best. It is possible, in fact, that most of the firms in the industry would find profitable operation impossible without the tax credits during this time period.

Aided by Federal tax credits, however, a broader market is supportable today in areas of high solar and wind resources, particularly in States that offer their own tax credits.

Furthermore, the private sector, in conjunction with the Federal energy R&D programs, can be expected to develop and improve solar and wind technologies. A number of these technologies will begin to become competitive and self-supporting on what we have termed a national level by the end of the decade.

In particular, expanded Federal tax credits will encourage nationwide competitiveness by 1990 for wind technologies in the electric utility market, and wind and solar thermal in the residential market.

With expanded tax credits and continued Federal R&D support, solar thermal electric and photovoltaic technologies should expand their competitiveness in remote, high-cost markets during the 1985 and 1990 timeframe and support capital cost reductions required for nationwide competitiveness in the post-1990 timeframe.

Continuation of the tax credits is therefore extremely important to the maintenance of a core solar industry—an industry that has

EXHIBIT I

IMPACT OF BUSINESS ENERGY TAX CREDITS ON U. S. TREASURY RECEIPTS

ENERGY TAX CREDITS AVAILABLE TO EQUITY SPONSORS OF A TYPICAL SHALE OIL PROJECT

ENERGY TAX CREDIT CALCULATION:

-

$1.3	Billion construction cost
x .38	Percent of construction costs qualifying for ETC
$494	Million qualified expenditure
x .10	Energy Tax Credit in the construction phase
$49.4	Million Energy Tax Credit

- **$16.4 Million per year average Energy Tax Credit taken.**

INCOME TAXES PAID BY LABOR FORCE DURING CONSTRUCTION PERIOD

INCOME TAXES PAYABLE CALCULATION:

- A typical shale oil project will employ 2,000 people in the construction phase (1984 - 1986).
- Average hourly wage rate (escalated) = $15.00
- Annual wages per person (escalated) = $30,000
- Annual income tax per person (escalated) = $8,500
- Other federal, state, and local taxes which will be paid in relation to construction of this project are not factored in.
- Total income taxes during construction period = $51 million
- **Average annual income taxes per year = $17 million**

the capability to deliver the improved products resulting from Federal R&D programs and private R&D programs. Without this core industry, it will be difficult to support the equipment service infrastructure necessary to maintain consumer confidence in solar/wind products. This confidence will be extremely important if solar/wind technologies are to be viable alternatives to future conventional energy problems.

Attainment of the market levels projected under an expanded tax credit scenario implies a considerable savings in fossil fuel requirements—up to 33 million barrels of oil per year by 1990, or roughly 2 percent of anticipated national oil import requirements. Furthermore, continued growth in the labor-intensive solar industry would provide significant employment opportunities by 1990.

Since the cost of a solar business tax credit is offset by a reduction in conventional fuel expense deductions over the life cycle of the system, the present value of continuing the current tax credits through 1990 could be as low as $100 million per year by 1990. That is, the direct cost to the Treasury of continued tax credits could be almost completely offset by revenue gains in the later years.

The actual impact on the Treasury will, of course, be dependent on actual market conditions, particularly the costs of—the avoided costs of fuel in the future.

In summary, continuing the tax credit for investment in solar wind technologies would enhance their financial attractiveness to consumers, raising current market penetration, and supporting the development of improved technologies at lower cost.

It would also maintain the industrial base and related consumer confidence necessary for successful deployment of solar wind technologies as they became cost effective without tax credit support in a post-1990 timeframe as other people have discussed earlier.

It would also encourage investment in a labor-intensive industry with prospects for significant product export.

It would also end up providing installed solar and wind energy capacity, as I have mentioned, that would be capable of producing the equivalent of 33 million barrels of imported oil by 1990.

These benefits could be attained at minimal present-value cost to the government due to the increased future tax revenues that offset near-term costs. The small viable industrial base complements the Federal R&D efforts to provide future generations of solar and wind technologies.

Thank you, Mr. Chairman. I would be happy to answer any questions that you have.

[The prepared statement of Mr. Babcock, and the impact study mentioned above follow:]

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Testimony to the
Subcommittee on Energy Development and Applications
House Science and Technology Committee

on

The Impact of Federal Energy Tax Credits on Solar/Wind Technologies

by
William H. Babcock
Booz Allen & Hamilton Inc.

July 21, 1983

THE IMPACT OF FEDERAL ENERGY TAX CREDITS ON SOLAR/WIND TECHNOLOGIES

At the request of the Solar Energy Industries Association, the Renewable Energy Institute and the American Wind Energy Association, Booz, Allen & Hamilton Inc. recently performed a study of the impacts of expanded solar/wind tax credits. We analyzed the impact on the solar industry, and on Treasury revenues, in the 1985-1990 time frame. The solar/wind applications that were analyzed are:

- Wind-electric, solar thermal electric, and photovoltaics in the electric utility market
- Solar thermal in the industrial market
- Solar thermal and wind-electric in the residential market.

The tax credit impacts were estimated by combining analyses of the economic attractiveness of each system, with information on the current status of each technology and estimates of future market potential.

The major conclusion of the study is that the availability of solar/wind tax credits beyond 1985 is essential to maintain the current solar industry. Furthermore, the long term direct cost to the Treasury -- of the tax credits -- could be largely offset by the increased tax revenues that will result from the decrease in conventional fuel tax deductions available to solar system owners in the business sector.

Without Federal and state energy tax credits, or unexpectedly large increases in the cost of conventional fuels, solar technologies will remain uncompetitive except in certain small niche markets--early adopters and remote applications, for example--and industry growth will be minimal, at best. It is possible, in fact, that most of the firms in the industry would find profitable operation impossible without the tax credits.

Aided by Federal tax credits, a broader market is supportable today in areas of high solar and wind resources, particularly in states that offer their own tax credits. Furthermore, the private sector, in conjunction with the Federal R&D program, can be expected to develop improved solar and wind technologies. A number of these technologies will begin to become competitive and self-supporting on a national level by the end of the decade. In particular,

- Expanded federal tax credits will encourage nationwide competitiveness by 1990 of wind technologies in the electric utility market, and wind and solar thermal in the residential market

- With expanded tax credits, and continued Federal R&D support, solar thermal electric and photovoltaic technologies should expand their competitiveness in remote, high-cost markets, which will support the capital cost reductions required for nationwide competitiveness in the post 1990 time frame.

Continuation of the tax credits is therefore extremely important to the maintenance of a core solar industry--an industry that has the capability to deliver the improved products resulting from Federal R&D programs. Without this core industry, it will be difficult to support the equipment service infrastructure necessary to maintain consumer confidence in solar/wind products. This confidence will be extremely important if solar/wind technologies are to be viable alternatives to future conventional energy problems.

Attainment of the market levels projected under an expanded tax credit scenario implies a considerable savings in fossil fuel requirements--up to 33 million barrels of oil per year by 1990, or roughly two percent of anticipated national oil import requirements. Furthermore, continued growth in the labor-intensive solar industry would provide significant employment opportunities by 1990.

Since the cost of a solar business tax credit is offset by a reduction in conventional fuel expense deductions, the present value of continuing the current tax credits through 1990 could be as low as $100 million per year by 1990. That is, the direct cost to the Treasury of continued tax credits could be almost completely offset by revenue gains in later years. The actual impact on the Treasury will, of course, be dependent on actual market conditions.

In summary, continuing the tax credit for investment in solar/wind technologies would:

- Enhance their financial attractiveness to consumers, raising market penetration and supporting the development of improved technologies at lower cost

- Maintain the industrial base and related consumer confidence necessary for successful deployment of solar and wind technologies as they become cost effective without tax credit support

- Encourage investment in a labor-intensive industry with prospects for significant product export
- Provide installed solar and wind energy capacity that is capable of replacing the equivalent of 33 million barrels of imported oil annually by 1990.

These benefits could be obtained at minimal present value cost to the government due to increased future tax revenues that offset near-term costs. In addition, maintaining a small, viable industrial base complements Federal R&D efforts to develop future generations of solar/wind technologies.

THE IMPACT OF FEDERAL ENERGY TAX CREDITS ON SOLAR/WIND TECHNOLOGIES

MAY, 1983

BOOZ·ALLEN & HAMILTON INC.

FOREWORD

- THIS PROJECT WAS CONDUCTED BY BOOZ, ALLEN & HAMILTON INC. FOR:
  - SOLAR ENERGY INDUSTRIES ASSOCIATION
  - RENEWABLE ENERGY INSTITUTE
  - AMERICAN WIND ENERGY ASSOCIATION
- THIS REPORT REPRESENTS THE FINAL BOOZ, ALLEN PROJECT DELIVERABLE. IT CONTAINS THE RESULTS OF AN INDEPENDENT ANALYSIS OF THE IMPACTS OF FEDERAL ENERGY TAX CREDITS ON SOLAR/WIND TECHNOLOGIES. THE RESULTS REPRESENT OUR BEST PROFESSIONAL JUDGEMENT BASED ON THE INFORMATION AVAILABLE TO US DURING THE PROJECT.

REPORT OUTLINE

- INTRODUCTION AND APPROACH
- ANALYTICAL RESULTS
    - FINANCIAL ANALYSIS
    - MARKET PENETRATION AND FUEL SAVINGS
- TREASURY IMPACTS
- SUMMARY OF IMPLICATIONS

INTRODUCTION

THIS REPORT PROVIDES AN OVERVIEW OF THE IMPACT OF TAX CREDITS ON THE FINANCIAL ATTRACTIVENESS AND POTENTIAL MARKET PENETRATION OF SOLAR AND WIND TECHNOLOGIES -- SPECIFICALLY RESIDENTIAL SOLAR, SOLAR THERMAL PROCESS HEAT, AND SOLAR THERMAL, PHOTOVOLTAIC, AND WIND ELECTRIC.

- THE FINANCIAL ATTRACTIVENESS OF SOLAR AND WIND TECHNOLOGIES WERE ANALYZED UNDER DIFFERENT SCENARIOS FOR:
  - TAX CREDITS
  - ENERGY PRICES
- CORRESPONDING MARKET PENETRATION SCENARIOS WERE DEVELOPED
- THE IMPACTS OF ALTERNATIVE PENETRATION SCENARIOS WERE ASSESSED IN TERMS OF
  - TREASURY LOSSES AND GAINS
  - EQUIVALENT LEVELS OF OIL SAVINGS
  - EMPLOYMENT OPPORTUNITIES.

KEY CHARACTERISTICS OF APPROACH

OUR APPROACH WAS TAILORED TO REFLECT LIMITED PROJECT RESOURCES AND THE SHORT TIME FRAME FOR THE ANALYSIS:

- WE UTILIZED A SINGLE SET OF CURRENT AND ANTICIPATED FUTURE CAPITAL COSTS AND EFFICIENCIES TO REPRESENT EACH SOLAR TECHNOLOGY BASED UPON RECENT DOE SPONSORED STUDIES, COMMUNICATIONS WITH GOVERNMENT AND INDUSTRY REPRESENTATIVES, AND DATA PROVIDED BY SOLAR/WIND EQUIPMENT MANUFACTURERS

- LOW/MODEST REAL CONVENTIONAL FUEL PRICE ESCALATION RATES (0-2%/YEAR) WERE UTILIZED

- AVAILABLE PUBLIC INFORMATION REGARDING POTENTIAL SOLAR MARKETS WAS RELIED UPON AS A BASIS FOR THE MARKET PENETRATION SCENARIOS

- QUANTITATIVE ANALYSIS OF SOLAR TAX CREDIT IMPACTS WAS LIMITED TO ESTIMATING THE DIRECT FINANCIAL IMPACTS ON THE U.S. TREASURY

OVERVIEW

- WITHOUT FEDERAL AND STATE ENERGY TAX CREDITS, ONLY SMALL NICHE MARKETS--"EARLY ADOPTERS AND REMOTE APPLICATIONS"--WILL EXIST GIVEN DEPRESSED FUEL PRICES
- AIDED BY FEDERAL TAX CREDITS, A BROADER MARKET IS SUPPORTABLE TODAY IN AREAS OF HIGH SOLAR AND WIND RESOURCES--PARTICULARLY IN STATES THAT OFFER THEIR OWN TAX CREDITS
- THE PRIVATE SECTOR CAN BE EXPECTED TO DEVELOP IMPROVED SOLAR AND WIND TECHNOLOGIES WHICH WILL BEGIN TO BECOME COMPETITIVE AND SELF-SUPPORTING ON A NATIONAL LEVEL BY THE END OF THE DECADE IF ASSISTED BY TAX CREDITS AND AUGMENTED BY FEDERALLY SPONSORED R&D
- TREASURY GAINS WILL LARGELY OFFSET THE COSTS OF THE TAX CREDIT, RESULTING IN LOW NET COSTS TO THE GOVERNMENT WHILE REDUCING THE NATIONAL OIL IMPORT BILL AND CREATING EMPLOYMENT AND EXPORT OPPORTUNITIES.

FINANCIAL ANALYSIS APPROACH

- THE FINANCIAL ATTRACTIVENESS OF SOLAR AND WIND APPLICATIONS DEPENDS UPON A LARGE NUMBER OF COST, PERFORMANCE, AND BUYER SPECIFIC FINANCIAL ASSUMPTIONS. OUR ANALYSIS OF THE CREDIT IMPACTS IS BASED UPON THE USE OF "TYPICAL" OR NATIONAL AVERAGES FOR KEY COST, PERFORMANCE, AND FINANCIAL ASSUMPTIONS (INCLUDED IN THE APPENDIX).

- WE HAVE UTILIZED A STANDARD LIFE CYCLE COST TECHNIQUE TO CALCULATE THE ANNALIZED LIFE CYCLE COSTS (ALCC) OF THE SOLAR/WIND ALTERNATIVES WITH CONVENTIONAL ENERGY SOURCES.

- AFTER-TAX COMPARISONS ARE MADE TO PROPERLY REFLECT FUEL EXPENSING, DEPRECIATION, INTEREST EXPENSE AND TAX CREDIT CONSIDERATIONS IN THE CALCULATIONS.

- ALL CALCULATIONS ARE DONE IN "REAL TERMS" -- I.E. THE IMPACTS OF GENERAL INFLATION HAVE BEEN REMOVED AND ONLY THOSE PRICE CHANGES OVER AND ABOVE INFLATION ARE CONSIDERED. CORRESPONDINGLY "REAL" DISCOUNT RATES AND INTEREST RATES WERE ALSO USED.

FINANCIAL ANALYSIS APPROACH (CONT'D)

- A TAX CREDIT EXTENSION TO 1990 WAS ANALYZED. BOTH A 15% AND A 25% BUSINESS INVESTMENT TAX CREDIT AND A 40% RESIDENTIAL TAX CREDIT WERE ANALYZED.

- ASSESSMENT OF THE FINANCIAL ATTRACTIVENESS OF SOLAR/WIND TECHNOLOGIES WAS THEREFORE LIMITED TO THE PERIOD BETWEEN NOW AND 1990. DETAILED CALCULATIONS WERE MADE FOR THE YEARS 1985 AND 1990.

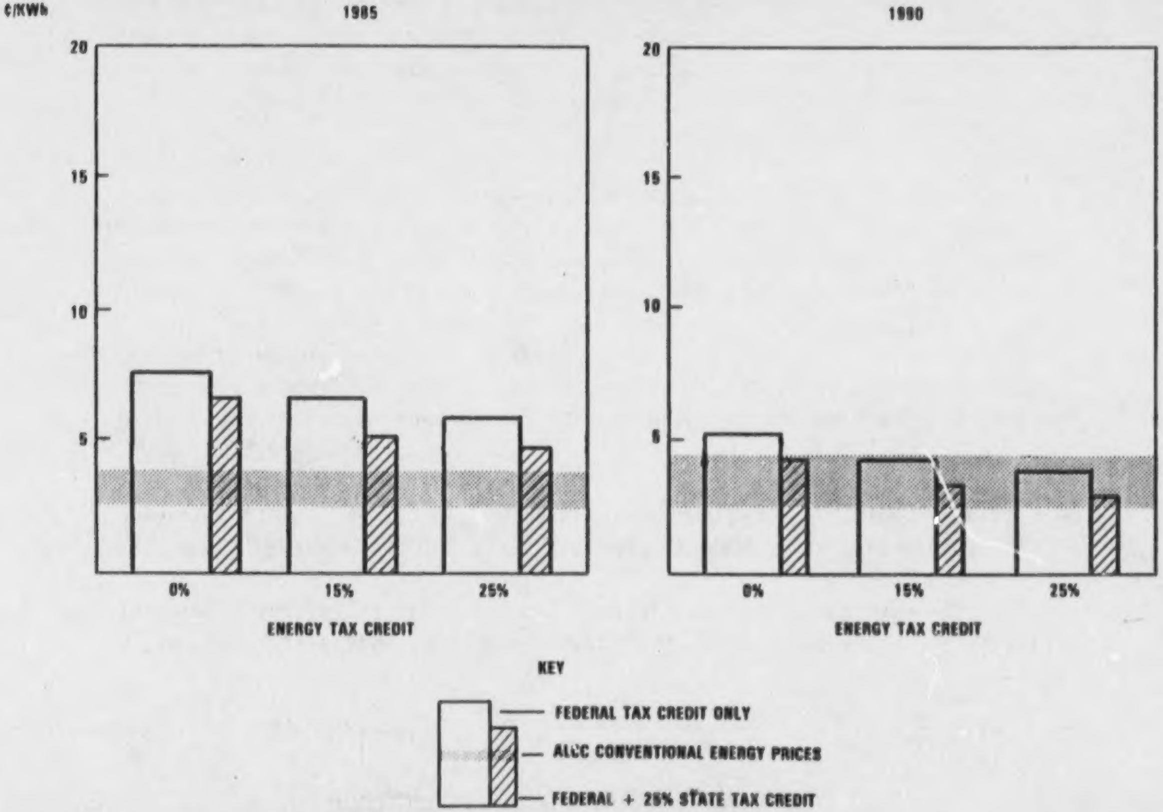
- BY LIMITING THE TIME FRAME OF ANALYSIS TO 1990, WE ARE ONLY ABLE TO CONSIDER THOSE COST REDUCTIONS THAT CAN BE INCORPORATED INTO SOLAR/WIND EQUIPMENT PRODUCTION WITHIN THE NEXT 7 YEARS.

- HENCE, OUR ASSESSMENTS OF SOLAR/WIND TECHNOLOGY COMPETITIVENESS SHOULD NOT BE USED AS AN INDICATOR OF THE LONG-TERM POTENTIAL FOR SOLAR/WIND TECHNOLOGIES. LONG-TERM FEDERAL R&D PROGRAM GOALS -- WHICH WOULD RESULT IN THE PARITY OF SOLAR/WIND TECHNOLOGIES WITH CONVENTIONAL ENERGY -- ARE SCHEDULED TO MEET DURING THE 1990'S.

- OUR ASSUMPTIONS PROVIDE A BENCHMARK FROM WHICH THE RELATIVE IMPACTS OF DIFFERENT ENERGY TAX CREDIT LEVELS CAN BE ASSESSED. THE ACTUAL DEGREE OF COST COMPETITIVENESS FOR INDIVIDUAL SOLAR AND WIND APPLICATIONS IS LIKELY TO DIFFER FROM OUR RESULTS, DEPENDING UPON UNIQUE LOCAL OR REGIONAL CONDITIONS.

ANNUALIZED LIFE CYCLE COSTS OF ELECTRICITY GENERATION FROM WIND TECHNOLOGY IN THE ELECTRIC UTILITY MARKET

(1983 DOLLARS)



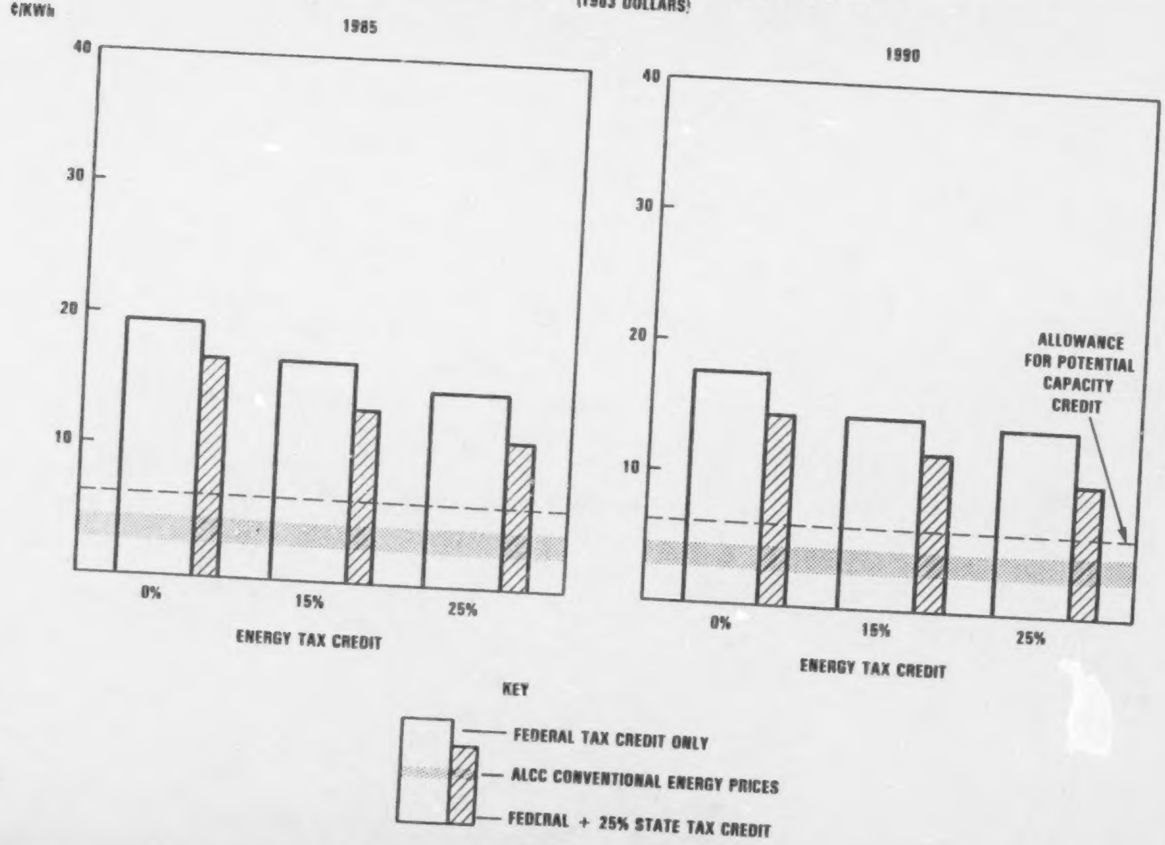
WIND ELECTRIC IN THE ELECTRIC UTILITY MARKET

- IF A 25% BUSINESS ENERGY INVESTMENT CREDIT IS AVAILABLE, WIND ELECTRIC SYSTEMS SHOULD BEGIN TO BECOME COMPETITIVE WITH DISTILLATE FUEL OIL FOR PEAK ELECTRICITY GENERATION AROUND 1985 IN STATES WITH 25% ENERGY TAX CREDITS AND ENERGY COSTS THAT ARE CLOSE TO THE NATIONAL AVERAGE.

- IF PROJECTED COST REDUCTIONS OF 40 PERCENT BETWEEN NOW AND 1990 ARE REALIZED, THE COMPETITIVE POSITION OF WIND ELECTRIC SYSTEMS WILL IMPROVE TO A POSITION WHERE THEY ARE FULLY COMPETITIVE WITHOUT TAX CREDITS IN THOSE MARKETS WITH SLIGHTLY HIGHER THAN AVERAGE ELECTRICITY COSTS.

ANNUALIZED LIFE CYCLE COSTS OF ELECTRICITY GENERATION FROM SOLAR THERMAL TECHNOLOGY IN THE ELECTRIC UTILITY MARKET

(1983 DOLLARS)



SOLAR THERMAL IN THE ELECTRIC UTILITY MARKET

- CURRENT SOLAR THERMAL ACTIVITY IN THE ELECTRIC UTILITY MARKET IS LIMITED TO PILOT AND DEMONSTRATION FACILITIES. PLANNING AND CONSTRUCTION LEAD TIMES WILL MOST LIKELY PRECLUDE FULL-SCALE OPERATION BEFORE 1988.

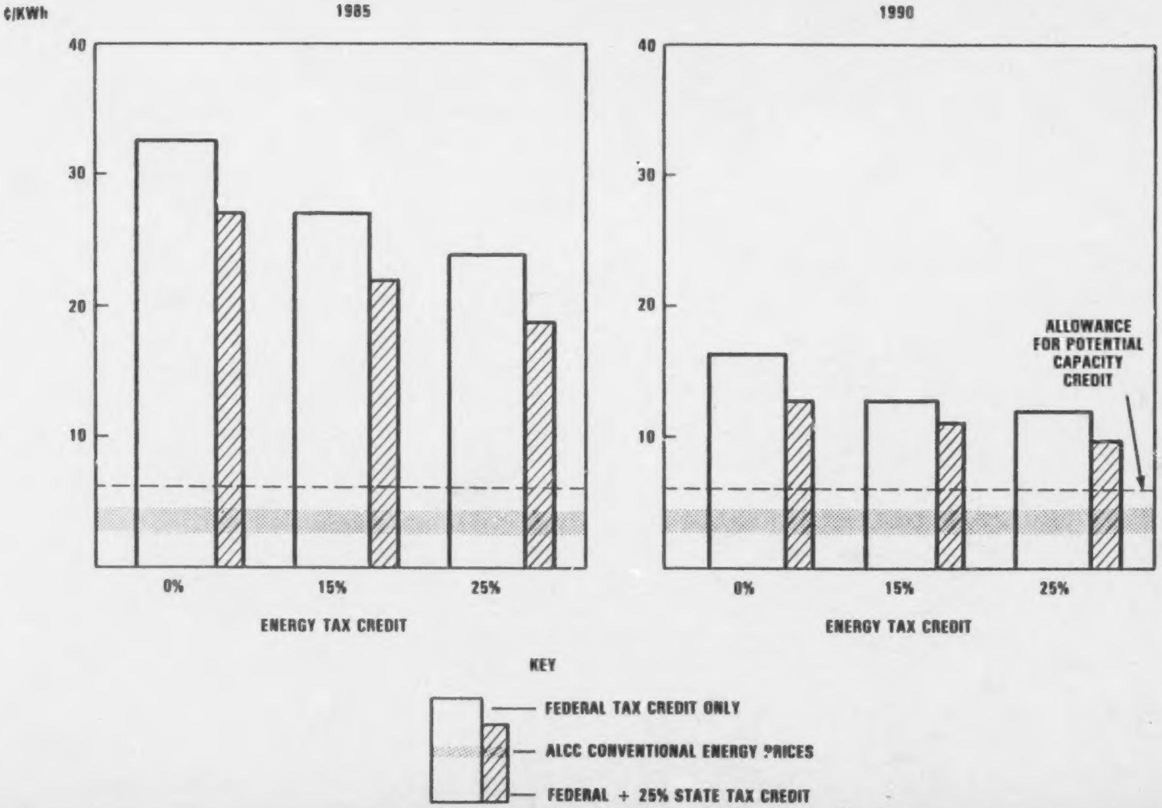
- CLOSE COUPLING OF SOLAR ELECTRIC OUTPUT WITH UTILITY LOAD PROFILES MAY ENABLE SYSTEMS TO QUALIFY FOR POTENTIAL CAPACITY CREDITS, INCREASING THEIR COMPETITIVENESS WITH CONVENTIONAL FUELS FOR ELECTRICITY GENERATION.

- HOWEVER, HIGH CAPITAL COSTS WILL PREVENT SOLAR THERMAL TECHNOLOGIES FROM ACHIEVING WIDESPREAD COMPETITIVENESS WITH DISTILLATE FUEL OIL BY THE END OF THE DECADE.

- THE EXISTENCE OF A TAX CREDIT PROGRAM MAY SUSTAIN PRIVATE DEVELOPMENTAL ACTIVITY IN THIS INDUSTRY, COMPLEMENTING THE GOVERNMENT SPONSORED R&D ACTIVITIES NECESSARY TO MAKE SOLAR THERMAL ELECTRIC TECHNOLOGY COMPETITIVE IN THE DECADE BEYOND THE TIMEFRAME OF THIS STUDY.

ANNUALIZED LIFE CYCLE COSTS OF ELECTRICITY GENERATION FROM PHOTOVOLTAIC TECHNOLOGY IN THE ELECTRIC UTILITY MARKET

(1983 DOLLARS)



PHOTOVOLTAIC IN THE ELECTRIC UTILITY MARKET

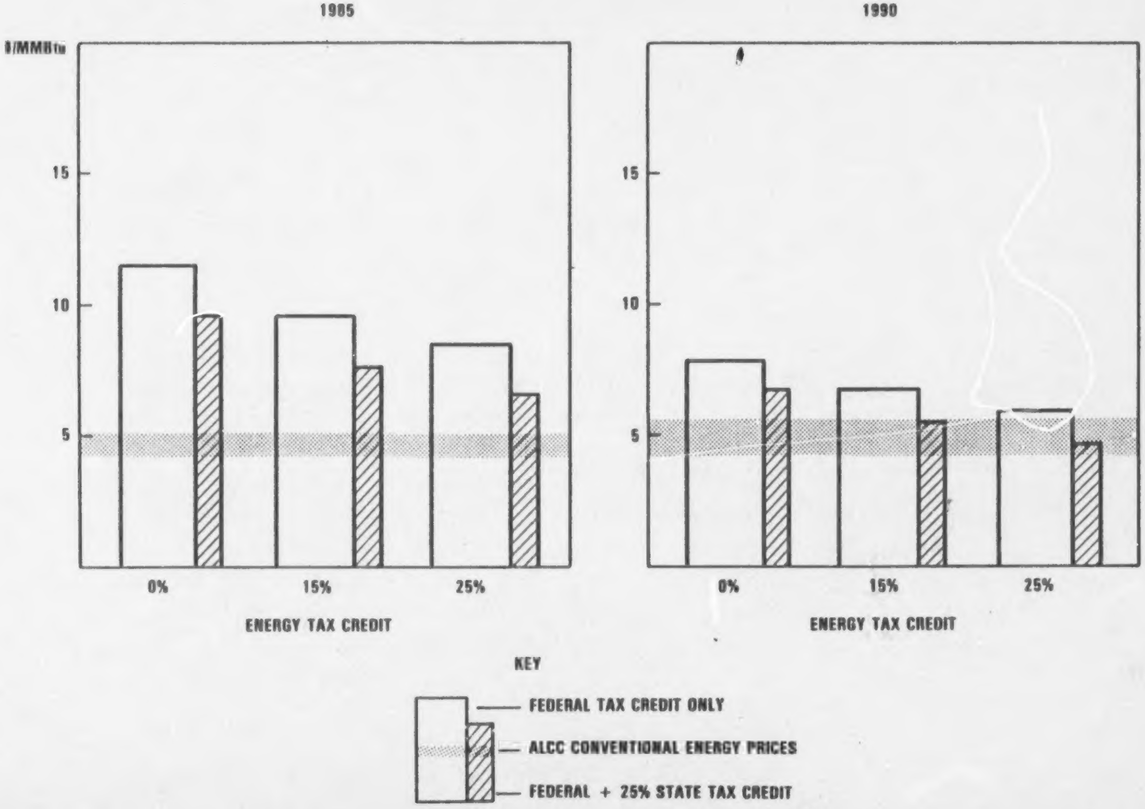
- AS WITH SOLAR THERMAL TECHNOLOGIES, HIGH CAPITAL COSTS AND THE LEAD TIMES ASSOCIATED WITH ADOPTION OF A NEW TECHNOLOGY BY THE UTILITY INDUSTRY WILL PREVENT PHOTOVOLTAIC TECHNOLOGIES FROM BECOMING WIDELY COMPETITIVE DURING THE 1980s. ASSUMING THAT PV COMPETES WITH DISTILLATE OIL FOR PEAK POWER GENERATION, PV GENERATED ELECTRICITY IS MORE EXPENSIVE THAN ELECTRICITY GENERATED WITH DISTILLATE OIL AT THE NATIONAL AVERAGE COST.

- HOWEVER, PHOTOVOLTAIC SYSTEMS MAY QUALIFY FOR POTENTIAL CAPACITY CREDITS, INCREASING THEIR COMPETITIVENESS WITH CONVENTIONAL FUELS FOR ELECTRICITY GENERATION IN HIGH COST, NICHE MARKETS.

- IN ADDITION, CAPITAL COST REDUCTIONS WILL ALLOW PHOTOVOLTAIC SYSTEMS TO IMPROVE THEIR COMPETITIVE POSITION IN REMOTE AREAS WITH HIGHER THAN AVERAGE COSTS AND IN AIR QUALITY NON-ATTAINMENT AREAS WHERE FOSSIL-FUEL PLANT OPERATION IS LIMITED.

ANNUALIZED LIFE CYCLE COSTS OF PROCESS HEAT FROM SOLAR THERMAL TECHNOLOGY IN THE INDUSTRIAL MARKET

(1983 DOLLARS)



SOLAR THERMAL IN THE INDUSTRIAL MARKET

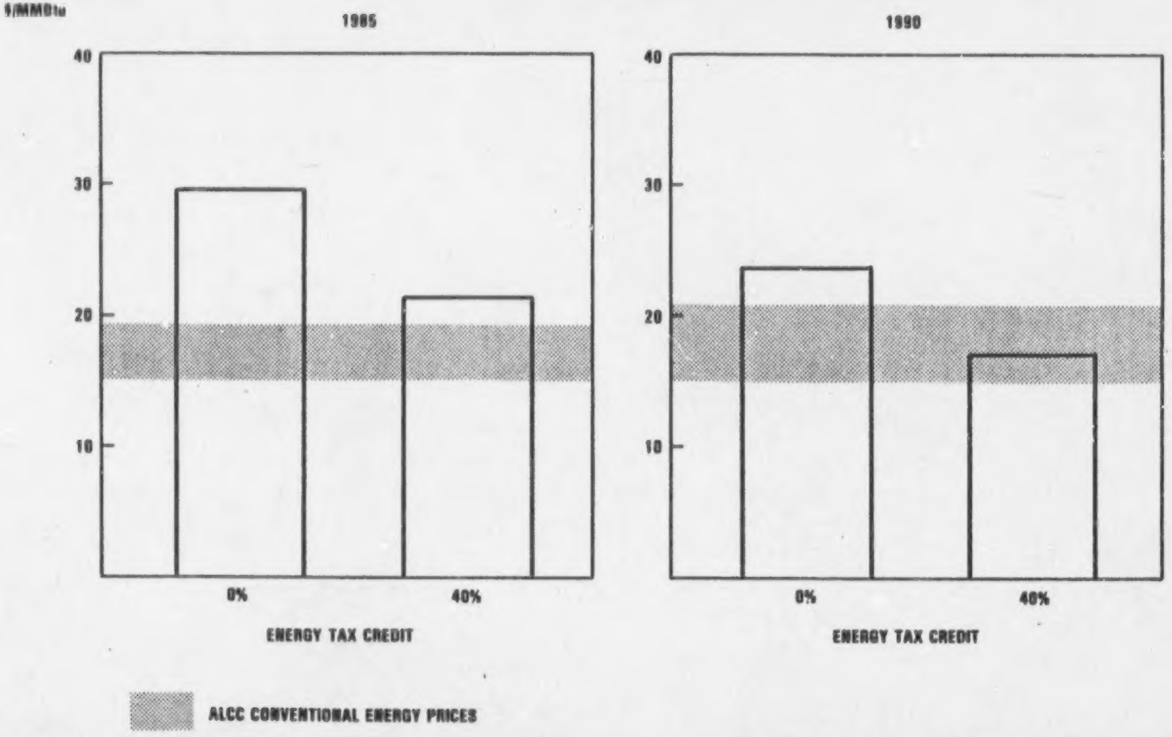
- CURRENT INDUSTRIAL SALES -- SUPPORTED BY EXISTING TAX CREDITS -- ARE TYPICALLY MADE TO CUSTOMERS LOCATED IN NON-ATTAINMENT AREAS OR TO THOSE FACING SUBSTANTIALLY HIGHER THAN AVERAGE FUEL COSTS.

- WITH ANTICIPATED REDUCTIONS OF 40 PERCENT IN SOLAR CAPITAL COSTS ACHIEVED BY THE END OF THIS DECADE, SOLAR THERMAL TECHNOLOGIES WILL BE COMPETITIVE WITHOUT TAX CREDIT SUPPORT IN THOSE REGIONS WITH HIGHER THAN AVERAGE FUEL COSTS. THEY WILL BE BROADLY COMPETITIVE ON A NATIONAL LEVEL IN 1990 WITH A 25% BUSINESS ENERGY INVESTMENT CREDIT.

- THEIR COMPETITIVE POSITION IS IMPROVED IN THOSE STATES THAT AUGMENT THE FEDERAL CREDIT WITH AN ADDITIONAL 25% STATE ENERGY TAX CREDIT.

ANNUALIZED LIFE CYCLE COSTS OF SOLAR TECHNOLOGY AND CONVENTIONAL ELECTRICITY IN THE RESIDENTIAL MARKET

(1983 DOLLARS)



SOLAR IN THE RESIDENTIAL MARKET

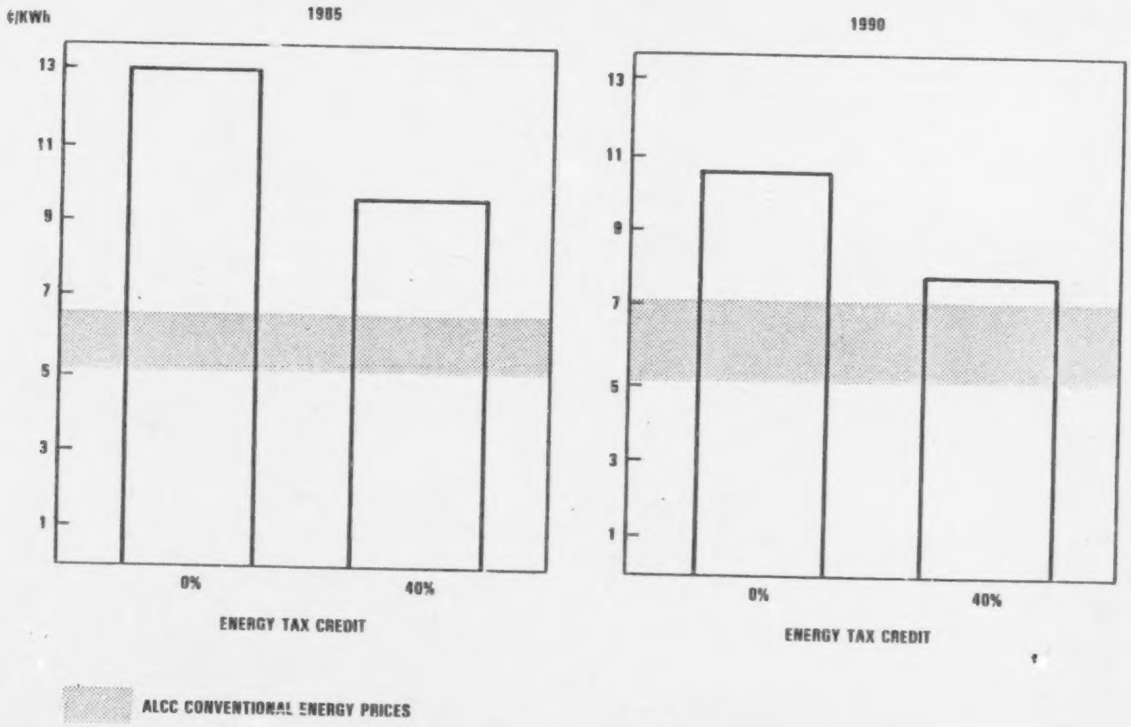
- ALTHOUGH RESIDENTIAL SOLAR SYSTEMS ARE CURRENTLY BEING PURCHASED--PRIMARILY IN STATES WITH SOLAR TAX CREDITS--INDUSTRY GROWTH NATIONWIDE IS CRITICALLY DEPENDENT ON CONTINUATION OF THE FEDERAL TAX CREDIT.

- IF THE 40% FEDERAL TAX CREDIT IS MAINTAINED THROUGH 1990, RESIDENTIAL SOLAR SYSTEMS SHOULD BECOME COMPETITIVE WITH ELECTRICITY IN MOST REGIONS OF THE COUNTRY THAT CAN BE CHARACTERIZED BY THE NATIONAL AVERAGE PRICES AND PERFORMANCE USED IN THIS STUDY.

- THE ABILITY TO MEET OR EXCEED THE PROJECTED PRODUCTION COST REDUCTIONS OF 27 PERCENT--AS WE ASSUMED WOULD TAKE PLACE BY THE END OF THE DECADE--REQUIRES CONTINUED INDUSTRY INVESTMENT, WHICH DEPENDS ON A CONTINUED TAX CREDIT PROGRAM TO ACHIEVE COMPETITIVENESS.

ANNUALIZED LIFE CYCLE COSTS OF WIND ELECTRIC TECHNOLOGY AND ELECTRICITY IN THE RESIDENTIAL MARKET

(1983 DOLLARS)



WIND ELECTRIC IN THE RESIDENTIAL MARKET

- WIND ELECTRIC SYSTEMS WILL BEGIN TO ACHIEVE WIDESPREAD COMPETITIVENESS IN THE RESIDENTIAL MARKET IN THE LATE 1980'S IF THE 40 PERCENT FEDERAL TAX CREDIT IS MAINTAINED, AND IF CAPITAL COST REDUCTIONS OF 40 PERCENT ARE ATTAINED.
- WITHOUT THE TAX CREDIT, MARKET ACTIVITY WILL CONTINUE TO BE VERY LOW, COST REDUCTIONS WILL BE MINIMAL, AND WIDESPREAD USE OF WIND ENERGY SYSTEMS PROBABLY WILL NOT DEVELOP IN THIS MARKET UNTIL WELL INTO THE 1990'S.

MARKET PENETRATION
AND
FUEL SAVINGS

MARKET PENETRATION APPROACH

- THE ACTUAL MARKET PENETRATION OF SOLAR AND WIND TECHNOLOGIES IS A FUNCTION OF A COMPLEX SET OF FINANCIAL, INSTITUTIONAL, AND MARKET FORCES

- TO ANALYZE THE IMPACT OF ALTERNATIVE ENERGY TAX CREDIT LEVELS, WE HAVE DEVELOPED A SET OF MARKET PENETRATION SCENARIOS THAT CONSISTENTLY REFLECT KEY ASSUMPTIONS REGARDING:
  - FUTURE SOLAR/WIND SYSTEM COSTS
  - ENERGY TAX CREDIT LEVELS
  - CONVENTIONAL FUEL PRICE ESCALATION RATES
  - ADDRESSABLE MARKETS
  - EXISTING AND POTENTIAL SOLAR/WIND MANUFACTURING CAPACITY

MARKET PENETRATION OVERVIEW

- THE RESULTS OF THE PRECEDING FINANCIAL ANALYSIS AND THE CURRENT STATUS OF SOLAR TECHNOLOGIES SUGGEST THAT MOST OF THE SOLAR MARKET ACTIVITY IN THE 1980'S WILL OCCUR IN FOUR APPLICATIONS:

    - WIND ELECTRIC SYSTEMS IN THE ELECTRIC UTILITY MARKET
    - SOLAR THERMAL SYSTEMS IN THE INDUSTRIAL MARKET
    - RESIDENTIAL SOLAR SYSTEMS IN THE BUILDINGS MARKET
    - WIND ELECTRIC SYSTEMS PRIMARILY IN THE RURAL RESIDENTIAL MARKET

  POTENTIAL MARKET PENETRATION OF PHOTOVOLTAIC AND SOLAR THERMAL TECHNOLOGIES IN THE ELECTRIC UTILITY MARKET MAY ULTIMATELY BE SIGNIFICANT, BUT THE LIKELIHOOD OF THIS TAKING PLACE BEFORE 1990 IS LOW

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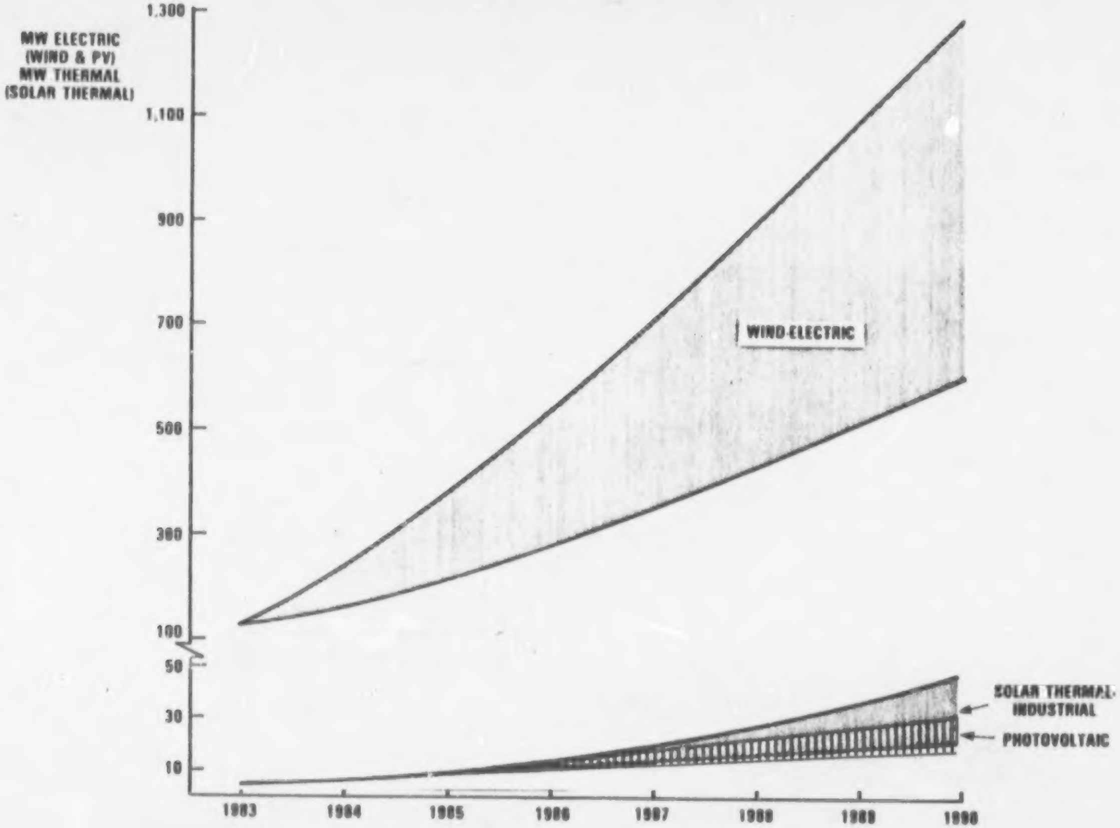
- CONTINUED GROWTH IN THIS LABOR-INTENSIVE INDUSTRY WOULD PROVIDE SIGNIFICANT EMPLOYMENT OPPORTUNITIES BY 1990.

PROJECTED PENETRATION OF WIND, SOLAR THERMAL, AND PHOTOVOLTAIC TECHNOLOGIES IN THE ELECTRIC UTILITY AND INDUSTRIAL MARKETS



MARKET PENETRATION . . .

ELECTRIC UTILITY AND INDUSTRIAL MARKETS

- WIND TECHNOLOGY IN THE ELECTRIC UTILITY MARKET OFFERS THE GREATEST PROSPECT FOR GROWTH IN THE 1980'S. CONSTRUCTION OF BETWEEN 3,000 AND 6,500 TYPICAL MACHINES B 1990 WOULD INCREASE TOTAL ANNUAL PENETRATION TO BETWEEN 600 AND 1300 MEGAWATTS -- UP FROM AN ESTIMATED ANNUAL PENETRATION OF 125 MEGAWATTS IN 1983.

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- A TOTAL OF 6.9 MEGAWATTS PEAK WERE SHIPPED IN 1982 -- OVER 25 PERCENT OF THE SHIPMENTS WERE EXPORTED, ACCORDING TO RECENT DOE SURVEY RESULTS.

- IT IS ESTIMATED THAT PHOTOVOLTAIC SYSTEMS TOTALING APPROXIMATELY TWO MEGAWATTS PEAK WERE ACTUALLY INSTALLED DOMESTICALLY IN 1982 -- PRIMARILY FOR REMOTE APPLICATIONS. ALTHOUGH FUTURE DOMESTIC INSTALLATION LEVELS ARE DIFFICULT TO PREDICT, IT IS CONCEIVABLE THAT ANNUAL DOMESTIC REMOTE AND PILOT INSTALLATIONS FOR CENTRAL STATION ELECTRICITY GENERATION COULD REACH 20 TO 30 MEGAWATTS BY 1990.

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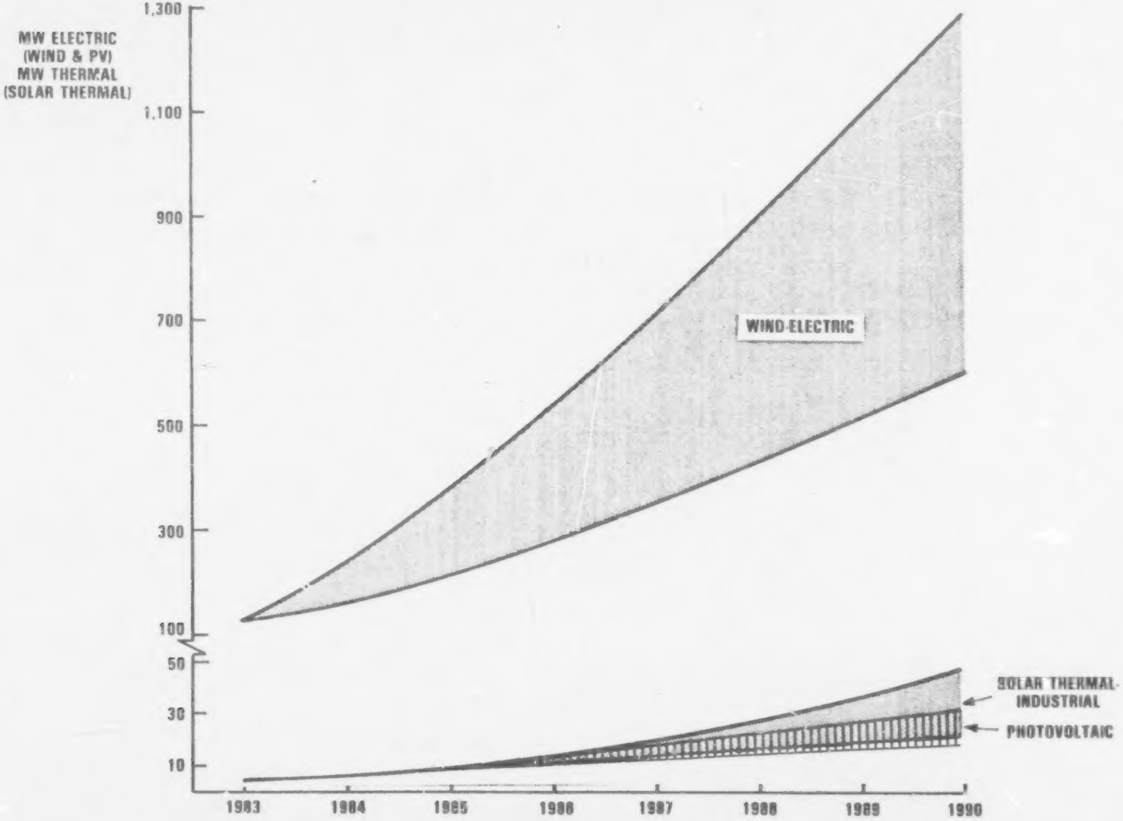

MARKET PENETRATION . . .

ELECTRIC UTILITY AND INDUSTRIAL MARKETS (CONT'D)

- COMMERCIAL-SCALE SOLAR THERMAL ELECTRIC TECHNOLOGIES WILL BE ECONOMIC ONLY IN LIMITED CIRCUMSTANCES BY THE END OF THIS DECADE. THUS, MARKET PENETRATION OF THESE TECHNOLOGIES WILL REMAIN VERY LOW THROUGH 1990.

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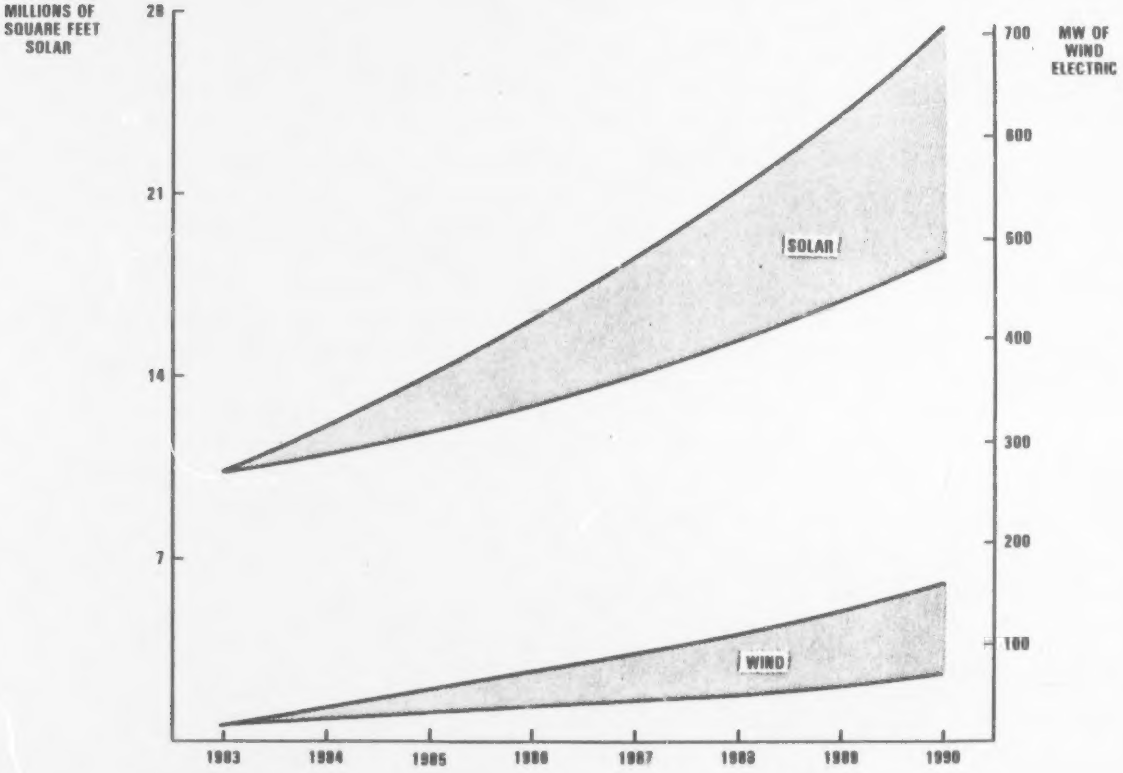


RESIDENTIAL MARKET

- CONTINUED FEDERAL ENERGY TAX CREDITS WOULD ENCOURAGE GROWTH IN SALES FOR RESIDENTIAL SOLAR TECHNOLOGIES. INCREASING TOTAL ANNUAL SALES IN THE RESIDENTIAL MARKET TO BETWEEN 18 AND 27.5 MILLION SQUARE FEET BY 1990 WOULD RESULT IN THE ANNUAL INSTALLATION BETWEEN 220,000 AND 360,000 HOT WATER SYSTEMS AND COMBINED HOT WATER AND SPACE HEATING SYSTEMS.

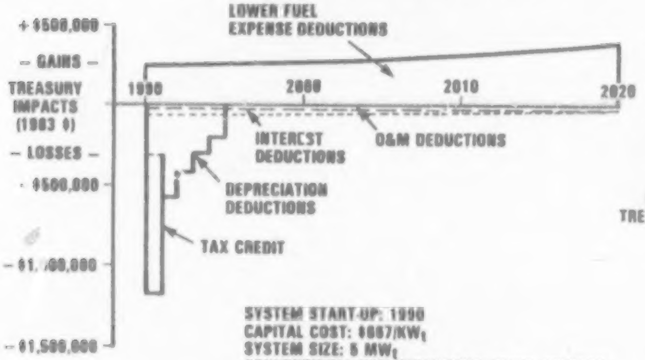
- ALTHOUGH MARGINALLY ECONOMIC IN MOST AREAS TODAY, RESIDENTIAL WIND SYSTEMS ARE EXPECTED TO GROW RAPIDLY FROM THEIR CURRENTLY SMALL BASE WITH THE AID OF CONTINUED FEDERAL TAX CREDITS. INCREASING SALES FROM 3,000 SMALL WIND SYSTEMS IN 1983 TO BETWEEN 12,000 AND 27,000 MACHINES IN 1990 WOULD BOOST ANNUAL SALES TO BETWEEN 70 AND 160 MEGAWATTS.

- IF THESE MARKET PENETRATION LEVELS ARE ATTAINED, A TOTAL ANNUAL SAVINGS OF BETWEEN 11 AND 15 MILLION BARRELS OF OIL COULD BE REALIZED BY 1990, AS SOLAR AND WIND TECHNOLOGIES SUBSTITUTE FOR CONVENTIONAL RESIDENTIAL ENERGY SOURCES.

TREASURY IMPACTS

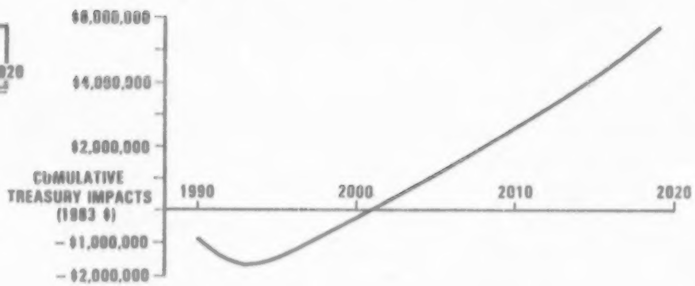
- TOTAL IMPACTS OF THE ENERGY TAX CREDIT WILL DEPEND UPON A VARIETY OF SOLAR/WIND INSTALLATION SPECIFIC FACTORS, AS WELL AS OVERALL NATIONAL ECONOMIC FACTORS:
  - DIRECT FINANCIAL FACTORS REFLECT THE LIFE CYCLE CASH FLOWS SOLELY ASSOCIATED WITH AN INDIVIDUAL SYSTEM: SYSTEM CAPITAL COSTS, ANNUAL FINANCIAL AND OPERATING COSTS AND FUEL EXPENSES.
  - INDIRECT MULTIPLIER FACTORS ATTEMPT TO CAPTURE THE NET IMPACTS ON GNP DUE TO EMPLOYMENT AND PROFITABILITY CHANGES IN THE SOLAR RELATED INDUSTRIES AND FUEL RELATED INDUSTRIES.
- OUR ANALYSIS IS LIMITED TO THE DIRECT FINANCIAL FACTORS WHERE THE COST TO THE FEDERAL TREASURY INCLUDES:
  - THE DIRECT COST OF THE ENERGY INVESTMENT TAX CREDIT IN THE FIRST YEAR
  - TAX DEDUCTIONS FOR DEPRECIATION OVER FIVE YEARS
  - TAX DEDUCTIONS FOR INTEREST OVER THE PERIOD THAT THE SYSTEM IS FINANCED
  - TAX DEDUCTIONS FOR O&M OVER THE LIFE OF THE SYSTEM
  - LOWER TAX DEDUCTIONS FOR CONVENTIONAL FUEL EXPENSES OVER THE LIFE OF THE SYSTEM.

ANNUAL TREASURY IMPACT
OF INDUSTRIAL SOLAR INVESTMENT



SYSTEM START-UP: 1990
CAPITAL COST: $667/KW$_t$
SYSTEM SIZE: 5 MW$_t$
CONVENTIONAL FUEL PRICE ESCALATION: 2%/YEAR
CASH FLOWS IN 1983 DOLLARS

CUMULATIVE NET TREASURY IMPACT
OF INDUSTRIAL SOLAR INVESTMENT



INSTALLATION SPECIFIC COSTS AND BENEFITS

- NEARLY ALL TAX SAVINGS (TREASURY COSTS) OCCUR IN THE FIRST FIVE YEARS

  - TAX CREDIT
  - DEPRECIATION

  WHILE SIGNIFICANT FUEL SAVINGS OCCUR OVER THE LIFE OF THE SYSTEM.

- THE PRESENT VALUE OF THE NET ANNUAL IMPACT ON THE U.S. TREASURY IS A FUNCTION OF KEY FINANCIAL AND OPERATING PARAMETERS -- CAPITAL COST, TAX CREDIT LEVEL, FUEL SAVINGS VALUE, SYSTEM LIFE, FINANCING, GOVERNMENT DISCOUNT RATE, EFFECTIVE INCOME TAX RATE.

- NET IMPACTS MAY BE POSITIVE OR NEGATIVE DEPENDING UPON THE SPECIFIC VALUES ASSUMED FOR KEY PARAMETERS. THE PRESENT VALUE OF NET TREASURY IMPACTS BECOME MORE POSITIVE AS:

  - SOLAR CAPITAL COST DECLINES
  - VALUE OF FUEL SAVINGS INCREASES
  - GOVERNMENT DISCOUNT RATE DECLINES.

IMPACT OF 25 PERCENT BUSINESS ENERGY INVESTMENT CREDIT ON THE FEDERAL TREASURY FOR SYSTEMS INSTALLED IN 1985 AND 1990

(MILLION 1983 DOLLARS)

START-UP DATE	REAL ENERGY PRICE ESCALATION	DIRECT COST OF 25% TAX CREDIT	PRESENT VALUE OF TOTAL REVENUE LOSS*	PRESENT VALUE OF TOTAL REVENUE GAIN*	PRESENT VALUE OF NET IMPACT*
1985	0%	$ 84	$ 277	$ 126	−$151
	2%	$105	$ 347	$ 305	−$ 42
1990	0%	$175	$ 573	$ 393	−$180
	2%	$365	$1203	$1795	+$592

*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

TREASURY IMPACTS . . .

TOTAL BUSINESS ENERGY INVESTMENT CREDIT COSTS TO THE TREASURY

- FROM THE OUTSET, TREASURY GAINS FROM REDUCED CONVENTIONAL FUEL COST DEDUCTIONS WILL PARTIALLY OFFSET THE COST OF THE TAX CREDIT FOR INDUSTRIAL AND ELECTRICITY GENERATING SOLAR/WIND SYSTEMS.

- BY 1990, LOWER SOLAR AND WIND CAPITAL COSTS AND HIGHER CONVENTIONAL FUEL PRICES MAY RESULT IN A NET GAIN TO THE TREASURY. THIS REFLECTS THE FACT THAT TOTAL LIFE CYCLE TREASURY IMPACTS BECOME MORE POSITIVE AS THE ECONOMIC ATTRACTIVENESS OF INDIVIDUAL SOLAR AND WIND SYSTEMS IMPROVES.

IMPACT OF 40 PERCENT RESIDENTIAL ENERGY TAX CREDIT ON THE FEDERAL TREASURY FOR SYSTEMS INSTALLED IN 1985 AND 1990

(MILLION 1983 DOLLARS)

START-UP DATE	REAL ENERGY PRICE ESCALATION	DIRECT COST OF 40% TAX CREDIT	PRESENT VALUE OF NET IMPACT*
1985	0%	$303	–$351
	2%	$359	–$416
1990	0%	$401	–$464
	2%	$646	–$748

*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

TOTAL RESIDENTIAL ENERGY TAX CREDIT COSTS TO THE TREASURY

- TAX CREDITS FOR RESIDENTIAL SYSTEMS, ALONG WITH THE BUSINESS ENERGY INVESTMENT CREDIT, PROVIDE NUMEROUS BENEFITS, INCLUDING:
  - CREATION OF EMPLOYMENT OPPORTUNITIES
  - REDUCTION IN OIL IMPORTS
  - DEVELOPMENT OF EXPORT INDUSTRY CAPABILITY.

  HOWEVER, RESIDENTIAL TAX CREDITS DO NOT PROVIDE THE TREASURY WITH OFFSETTING REVENUES, AS DOES THE BUSINESS ENERGY INVESTMENT CREDIT.

- IF WAGES CONTINUE TO ACCOUNT FOR APPROXIMATELY 40 PERCENT OF THE INSTALLED COST OF SOLAR AND WIND SYSTEMS, DOMESTIC RESIDENTIAL SYSTEM MANUFACTURE AND INSTALLATION WOULD REPRESENT OVER A $1 BILLION INDUSTRY. EMPLOYEES IN THE SOLAR INDUSTRY CAN, CORRESPONDINGLY, BE EXPECTED TO DOUBLE FROM TODAY'S LEVELS -- WHICH HAVE BEEN ESTIMATED TO BE 30,000 TO 40,000 WORKERS NATIONWIDE.

SUMMARY OF IMPLICATIONS

CONTINUING THE TAX CREDIT FOR INVESTMENT IN SOLAR/WIND TECHNOLOGIES WOULD:

- ENHANCE THEIR FINANCIAL ATTRACTIVENESS TO CONSUMERS, RAISING MARKET PENETRATION AND SUPPORTING THE DEVELOPMENT OF IMPROVED TECHNOLOGIES AT LOWER COST.
- MAINTAIN THE INDUSTRIAL BASE AND RELATED CONSUMER CONFIDENCE NECESSARY FOR SUCCESSFUL DEPLOYMENT OF SOLAR AND WIND TECHNOLOGIES AS THEY BECOME COST EFFECTIVE WITHOUT TAX CREDIT SUPPORT
- ENCOURAGE INVESTMENT IN A LABOR-INTENSIVE INDUSTRY WITH PROSPECTS FOR SIGNIFICANT PRODUCT EXPORT.
- PROVIDE INSTALLED SOLAR AND WIND ENERGY CAPACITY THAT IS CAPABLE OF REPLACING THE EQUIVALENT OF 33 MILLION BARRELS OF IMPORTED OIL ANNUALLY BY 1990.

THESE BENEFITS WOULD BE OBTAINED AT MINIMAL PRESENT VALUE COST TO THE GOVERNMENT DUE TO INCREASED FUTURE REVENUES THAT OFFSET NEAR-TERM COSTS. IN ADDITION, MAINTAINING A SMALL, VIABLE INDUSTRIAL BASE WILL COMPLEMENT FEDERAL R&D EFFORTS TO DEVELOP FUTURE GENERATIONS OF SOLAR/WIND TECHNOLOGIES.

SUMMARY OF ASSUMPTIONS

	UTILITY/INDUSTRIAL	RESIDENTIAL
O DEBT FINANCING	40%	80%
O REAL DEBT INTEREST RATE	3%	4%
O REAL DISCOUNT RATE	15%	10%
O REAL RETURN ON EQUITY*	20%	
O MARGINAL TAX RATE	50%	30%
O FUEL EFFICIENCY		
- ELECTRICITY GENERATION	35%	NA
- PROCESS HEAT GENERATION	70%	NA
- ELECTRICITY APPLICATION	NA	95%
O SYSTEM LIFE	30 YEARS	30 YEARS
O REAL CONVENTIONAL FUEL COST ESCALATION (OVER 30 YEARS)		
- LOW	0%/YEAR	
- HIGH	2%/YEAR	
O LOAD FACTOR		
- SOLAR	30%	
- WIND	25%	

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* REAL RETURN ON EQUITY CORRESPONDS TO THAT RATE REQUIRED BY THIRD PARTY INVESTORS ON SIMILAR TYPES OF FINANCIAL INVESTMENTS.

SUMMARY OF CAPITAL AND O&M COSTS FOR SOLAR AND WIND TECHNOLOGIES
(1983 DOLLARS)

TECHNOLOGY/MARKET	CAPITAL COST	O&M COST
WIND-ELECTRIC	$1,750/KW (1983) $1,500/KW (1985) $1,000/KW (1990)	2.0% CAPITAL/YEAR
PHOTOVOLTAIC-ELECTRIC	$10,000/KW (1983) $8,000/KW (1985) $4,000/KW (1990)	0.1% CAPITAL/YEAR
SOLAR THERMAL-ELECTRIC	$7,000/KW (1983) $4,800/KW (1985) $3,700/KW (1990)	0.25% CAPITAL/YEAR
SOLAR THERMAL-INDUSTRIAL	$1,100/KWT (1983) $950/KWT (1985) $670/KWT (1990)	0.2% CAPITAL/YEAR
WIND-RESIDENTIAL	$2500/KW (1983) $2300/KW (1985) $1875/KW (1990)	
ACTIVE SOLAR-RESIDENTIAL	$55/FT. (1983) $50/FT. (1985) $40/FT. (1990)	1.0% CAPITAL/YEAR

SOURCES:

DOE, SOUTHWEST PROJECT
BAH/DOE, SOLAR CENTRAL RECEIVERS
ADL, THE COST OF FEDERAL TAX CREDIT PROGRAMS
URBAN SYSTEMS, ANALYSIS OF THE IMPACT OF FEDERAL TAX INCENTIVES
BOOZ, ALLEN & HAMILTON INC.

ANNUALIZED LIFE CYCLE COST (ALCC) EQUATIONS

$$\text{ALCC (Conv. Fuel)} = (\text{CRF}_{i,N})P_o(1-\tau)\left(\frac{1+e}{i-e}\right)\left[1-\left(\frac{1+e}{1+i}\right)^N\right] \quad \text{if } i \neq e$$

Where:

P_j = the efficiency-adjusted conventional fuel price in the jth year of system operation

$\text{CRF}_{i,N}$ = capital recovery factor based on system owner's discount rate

i = system owner's discount rate

N = lifetime of solar system

$$\text{ALCC (Solar)} = (\text{FCR})\,\frac{\text{capital cost}}{\text{MMBtu/yr}}$$

$$\text{CRF} = \frac{r}{1-(1+r)^{-N}}$$

Where r = appropriate discount rate

FIXED CHARGE RATE FORMULAS FOR DIFFERENT CLASSES OF SYSTEM OWNERS

Ownership Class	Fixed Charge Rate Formulas			
	Annual Capital Expenses	Other Expenses	Tax Deductions	Investment Tax Credit
Residential (Private Citizen)	$\overline{CRF}_p$	$+\beta_1+\beta_2+m$	$-\tau_p(\beta_1+\beta_2+\bar{r}f_r)$	$-\frac{\alpha_p}{1+i}\left[\overline{CRF}_p-\tau_p\bar{r}f_r\right]$
Business (Corporation)	$\overline{CRF}_B$	$+\beta_1+\beta_2+m$	$-\tau_B(\beta_1+\beta_2+m+\bar{r}f_r+d)$	$-\frac{\alpha_B}{1+i}\left[\overline{CRF}_B-\tau_b\bar{r}f_r\right]$

Notes: 1) $\overline{CRF}$ = The weighted average corporate capital recovery factor

For residential ownership, $\overline{CRF}_p = CRF_r f_r + CRF_i (1-f_r)$

For business ownership, $CRF_B = CRF_b f_b + CRF_c f_c + CRF_d f_d$

2) It is assumed that the investment tax credit is taken at the end of the first year of system operation. Its discounted value is credited against the system's capital cost.

25-094 O—83——17

GLOSSARY OF TERMS USED IN FIXED CHARGE RATE FORMULAS

CRF: The capital recovery factor: the uniform periodic payment expressed as a fraction of the original principal, that will fully repay a loan, including all interest, in a predetermined number of periods.

CRF_i : The capital recovery factor in the case where the interest rate is equal to the system owner's discount rate (i).

$CRF_r f_r$: Annual mortgage payment on the fraction (f_r) of a S1 investment financed through floating a loan.

$CRF_c f_c$: Annual payment to holders of common stock issued to finance a fraction (f_c) of a S1 investment.

$CRF_p f_p$: Annual payment to holders of preferred stock issued to finance a fraction (f_d) of a S1 investment.

$CRF_b f_b$: Annual payment to holders of bonds issued to finance a fraction (f_b) of a S1 investment.

β_1 : Annualized preset value (PV) of all non-income tax payments (primarily property taxes), expressed as a fraction of the initial capital investment (CI).

β_2 : Annualized PV of all insurance premiums, expressed as a fraction of CI.

m : Annualized PV of all operating maintenance, and replacement expenses, expressed as a fraction of CI.

$\bar{r}$: Annualized PV of all interest deductions, expressed as a fraction of CI.

d : Annualized PV of depreciation deductions, expressed as a fraction of CI.

i : System Owner's discount rate.

α_p : Tax credit available to a residential owner of a solar system expressed as a fraction of CI.

GLOSSARY OF TERMS USED IN FIXED CHARGE RATE FORMULAS (CONT'D)

α_B : Tax credit available to a business owner of a solar system expressed as a fraction of CI.

τ_p : Marginal personal income tax rate.

τ_B : Effective marginal personal income tax rate.

THE IMPACT OF FEDERAL ENERGY TAX CREDITS ON SOLAR/WIND TECHNOLOGIES

EXECUTIVE SUMMARY

MAY, 1983

BOOZ·ALLEN & HAMILTON INC.

FOREWORD

- THIS PROJECT WAS CONDUCTED BY BOOZ, ALLEN & HAMILTON INC. FOR:
    - SOLAR ENERGY INDUSTRIES ASSOCIATION
    - RENEWABLE ENERGY INSTITUTE
    - AMERICAN WIND ENERGY ASSOCIATION
- THIS REPORT REPRESENTS THE FINAL BOOZ, ALLEN PROJECT DELIVERABLE. IT CONTAINS THE RESULTS OF AN INDEPENDENT ANALYSIS OF THE IMPACTS OF FEDERAL ENERGY TAX CREDITS ON SOLAR/WIND TECHNOLOGIES. THE RESULTS REPRESENT OUR BEST PROFESSIONAL JUDGMENT BASED ON THE INFORMATION AVAILABLE TO US DURING THE PROJECT.

OVERVIEW

- WITHOUT FEDERAL AND STATE ENERGY TAX CREDITS, ONLY SMALL NICHE MARKETS--"EARLY ADOPTERS AND REMOTE APPLICATIONS"--WILL EXIST GIVEN DEPRESSED FUEL PRICES
- AIDED BY FEDERAL TAX CREDITS, A BROADER MARKET IS SUPPORTABLE TODAY IN AREAS OF HIGH SOLAR AND WIND RESOURCES--PARTICULARLY IN STATES THAT OFFER THEIR OWN TAX CREDITS
- THE PRIVATE SECTOR CAN BE EXPECTED TO DEVELOP IMPROVED SOLAR AND WIND TECHNOLOGIES, WHICH WILL BEGIN TO BECOME COMPETITIVE AND SELF-SUPPORTING ON A NATIONAL LEVEL BY THE END OF THE DECADE IF ASSISTED BY TAX CREDITS AND AUGMENTED BY FEDERALLY SPONSORED R&D
- TREASURY GAINS WILL LARGELY OFFSET THE COSTS OF THE TAX CREDIT, RESULTING IN LOW NET COSTS TO THE GOVERNMENT WHILE REDUCING THE NATIONAL OIL IMPORT BILL AND CREATING EMPLOYMENT AND EXPORT OPPORTUNITIES.

FINANCIAL ANALYSIS OVERVIEW

- THE FINANCIAL ATTRACTIVENESS OF SOLAR AND WIND APPLICATIONS DEPENDS UPON A LARGE NUMBER OF COST, PERFORMANCE AND BUYER SPECIFIC FINANCIAL ASSUMPTIONS

- BASED UPON THE USE OF "TYPICAL" OR NATIONAL AVERAGES FOR KEY COST, PERFORMANCE, AND FINANCIAL ASSUMPTIONS, OUR RESULTS SUGGEST THAT:

  - WITHOUT FEDERAL TAX CREDITS, SOLAR AND WIND TECHNOLOGIES WILL REMAIN UNCOMPETITIVE EXCEPT IN NICHE MARKETS THROUGH 1990

  - EXPANDED FEDERAL TAX CREDITS WILL ENCOURAGE NATIONWIDE COMPETITIVENESS OF WIND TECHNOLOGIES IN THE ELECTRIC UTILITY MARKET, SOLAR THERMAL IN THE INDUSTRIAL MARKET, AND WIND AND SOLAR IN THE RESIDENTIAL MARKET BY 1990

  - WITH EXPANDED TAX CREDITS, SOLAR THERMAL AND PHOTOVOLTAIC TECHNOLOGIES IN THE ELECTRIC UTILITY MARKET WILL BECOME COMPETITIVE IN REMOTE, HIGH-COST MARKETS, EVENTUALLY LEADING TO CAPITAL COST REDUCTIONS AND POTENTIAL NATIONWIDE COMPETITIVENESS IN THE POST 1990 TIMEFRAME

- THE COST COMPETITIVENESS OF INDIVIDUAL SOLAR AND WIND APPLICATIONS MAY DIFFER FROM OUR RESULTS, DEPENDING UPON UNIQUE LOCAL OR REGIONAL CONDITIONS

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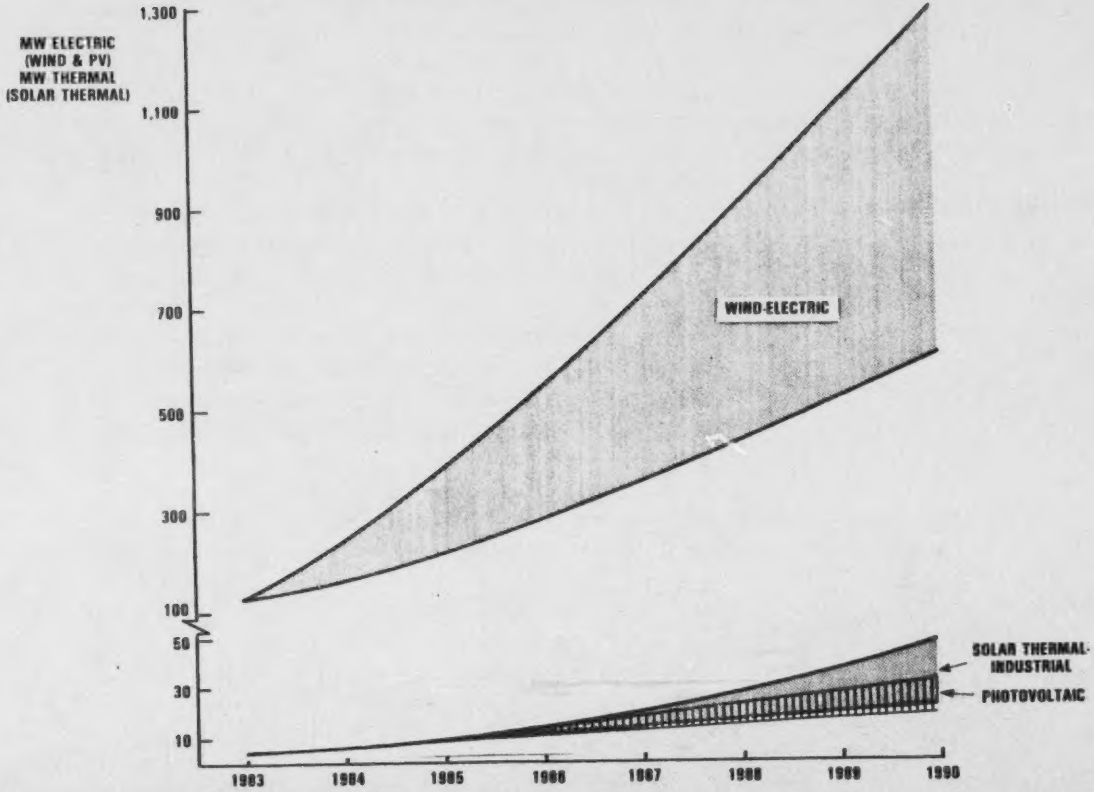

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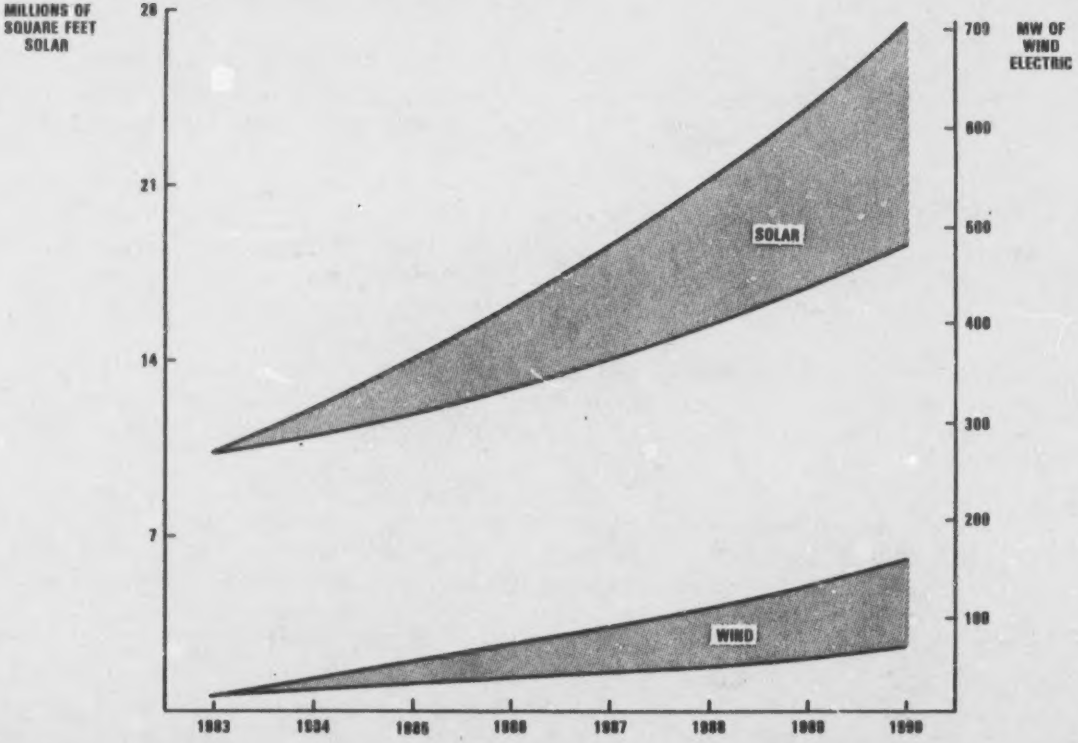
PROJECTED PENETRATION OF SOLAR AND WIND ELECTRIC TECHNOLOGIES IN THE RESIDENTIAL MARKET



Mr. **Fuqua**. Thank you very much.

Mr. Babcock, do you think that the residential tax credits are inducing the equipment manufacturers to keep their prices higher than they otherwise would?

Mr. **Babcock**. I think that—let me put it this way—we have not studied that question so this would be just purely an opinion of mine. I think that there is probably some tendency. If you look around the country and the States with the highest tax credits, I think that you also see a higher per-square-foot cost. I would guess maybe in the 5- to 10-percent range, but there is great variance in costs across the country.

Mr. **Fuqua**. What do you estimate to be the direct cost to the Treasury in the 1985 to 1990 timeframe by extending the solar business tax credit and also increasing their value up to 25 percent?

Mr. **Babcock**. OK. One of the things that I wanted to say about that would be if you look at just the period in the 1990—or 1985 to 1990 timeframe—we did not calculate a cost to the Treasury during that timeframe. What we took out was a life cycle view, so the present value costs for the tax credits that would be taken during that timeframe would range from—let me just check my numbers here—would range in one of our scenarios from a negative $151 million to a positive $592 million.

Now, that would be on an annual basis for tax credits taken in a single year. So there is quite a variance, depending upon the fuel price escalation rates that one assumes through time. We view the energy investment credit as a form of insurance in the sense that if the Government would be investing in the opportunity to forego future price rises, future escalation rates, and if the future escalation rates are very high, that would reduce the tax writeoffs or tax expenses for firms, resulting in higher tax revenues, then.

Mr. **Fuqua**. Mr. Bos, it appears from your statement that H.R. 1775 provides just enough incentive to keep the solar technologies viable until they achieve economic competitiveness around the year 1994. Is that true, and are you confident with that result?

Mr. **Bos**. Mr. Chairman, from our analysis, it shows that for the expected scenario in terms of installed costs, which assumes the existence of tax incentive legislation for the commercialization process, we can predict market penetration for these technologies, since under these conditions, the breakeven point between perceived value and cost would occur by 1995.

However, there is a significantly large variation, as you can see in the figures, between the pessimistic and the optimistic case as compared to the expected case. There is significant uncertainty in the technologies themselves, as well as in the rate of penetration, which, when they interact, brings you down to different levels of the learning experience which are a result of increased production.

Therefore we have looked at the diffusion process under different scenarios and calculated the values and the losts under different conditions.

Based upon our analysis for the expected scenario, we feel reasonably certain that this commercialization will take place. There might, however, be some deviation because of uncertainties. Furthermore, as I mentioned before, in addition to the Federal tax in-

RESIDENTIAL MARKET

- CONTINUED FEDERAL ENERGY TAX CREDITS WOULD ENCOURAGE GROWTH IN SALES FOR RESIDENTIAL SOLAR TECHNOLOGIES. INCREASING TOTAL ANNUAL SALES IN THE RESIDENTIAL MARKET TO BETWEEN 18 AND 27.5 MILLION SQUARE FEET BY 1990 WOULD RESULT IN THE ANNUAL INSTALLATION BETWEEN 220,000 AND 360,000 HOT WATER SYSTEMS AND COMBINED HOT WATER AND SPACE HEATING SYSTEMS.

- ALTHOUGH MARGINALLY ECONOMIC IN MOST AREAS TODAY, RESIDENTIAL WIND SYSTEMS ARE EXPECTED TO GROW RAPIDLY FROM THEIR CURRENTLY SMALL BASE WITH THE AID OF FEDERAL TAX CREDITS. INCREASING SALES FROM 3,000 SMALL WIND SYSTEMS IN 1983 TO BETWEEN 12,000 AND 27,000 MACHINES IN 1990 WOULD BOOST ANNUAL SALES TO BETWEEN 70 AND 160 MEGAWATTS.

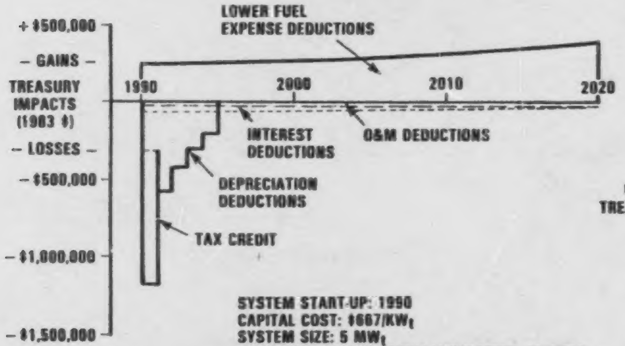
- IF THESE MARKET PENETRATION LEVELS ARE ATTAINED, A TOTAL ANNUAL SAVINGS OF BETWEEN 11 AND 15 MILLION BARRELS OF OIL COULD BE REALIZED BY 1990, AS SOLAR AND WIND TECHNOLOGIES SUBSTITUTE FOR CONVENTIONAL RESIDENTIAL ENERGY SOURCES.

IMPACT OF 25 PERCENT BUSINESS ENERGY INVESTMENT CREDIT ON THE FEDERAL TREASURY FOR SYSTEMS INSTALLED IN 1985 AND 1990
(MILLION 1983 DOLLARS)

START-UP DATE	REAL ENERGY PRICE ESCALATION	DIRECT COST OF 25% TAX CREDIT	PRESENT VALUE OF TOTAL REVENUE LOSS*	PRESENT VALUE OF TOTAL REVENUE GAIN*	PRESENT VALUE OF NET IMPACT*
1985	0%	$ 84	$ 277	$ 126	−$151
	2%	$105	$ 347	$ 305	−$ 42
1990	0%	$175	$ 573	$ 393	−$180
	2%	$365	$1203	$1795	+$592

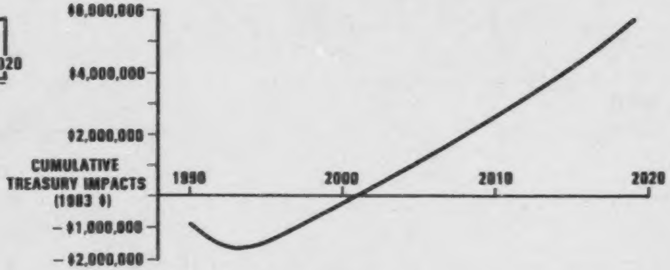
*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

ANNUAL TREASURY IMPACT OF INDUSTRIAL SOLAR INVESTMENT



SYSTEM START-UP: 1990
CAPITAL COST: $667/$KW_t$
SYSTEM SIZE: 5 MW_t
CONVENTIONAL FUEL PRICE ESCALATION: 2%/YEAR
CASH FLOWS IN 1983 DOLLARS

CUMULATIVE NET TREASURY IMPACT OF INDUSTRIAL SOLAR INVESTMENT



TREASURY IMPACTS . . .

TOTAL BUSINESS ENERGY INVESTMENT CREDIT COSTS TO THE TREASURY

- NEARLY ALL TREASURY COSTS OCCUR IN THE FIRST FIVE YEARS AFTER CONSTRUCTION, WHEREAS TAX REVENUE GAINS FROM CONVENTIONAL FUEL SAVINGS OCCUR OVER THE LIFE OF THE SYSTEM

- FROM THE OUTSET, TREASURY GAINS FROM REDUCED CONVENTIONAL FUEL COST DEDUCTIONS WILL PARTIALLY OFFSET THE COST OF THE TAX CREDIT FOR INDUSTRIAL AND ELECTRIC UTILITY SOLAR AND WIND SYSTEMS

- BY 1990, LOWER SOLAR AND WIND TECHNOLOGY CAPITAL COSTS AND HIGHER CONVENTIONAL FUEL PRICES MAY RESULT IN A NET ANNUAL GAIN TO THE TREASURY. THIS REFLECTS THE FACT THAT TOTAL LIFE-CYCLE TREASURY IMPACTS BECOME MORE POSITIVE AS THE ECONOMIC ATTRACTIVENESS OF INDIVIDUAL SOLAR AND WIND SYSTEMS IMPROVES.

IMPACT OF 40 PERCENT RESIDENTIAL ENERGY TAX CREDIT ON THE FEDERAL TREASURY FOR SYSTEMS INSTALLED IN 1985 AND 1990

(MILLION 1983 DOLLARS)

START-UP DATE	REAL ENERGY PRICE ESCALATION	DIRECT COST OF 40% TAX CREDIT	PRESENT VALUE OF NET IMPACT*
1985	0%	$303	–$351
	2%	$359	–$416
1990	0%	$401	–$464
	2%	$646	–$748

*DISCOUNT RATE = 7%, AS REQUIRED BY OMB.

TOTAL RESIDENTIAL ENERGY TAX CREDIT COSTS TO THE TREASURY

- TAX CREDITS FOR RESIDENTIAL SYSTEMS, ALONG WITH THE BUSINESS ENERGY INVESTMENT CREDIT, PROVIDE NUMEROUS BENEFITS, INCLUDING:
  - CREATION OF EMPLOYMENT OPPORTUNITIES
  - REDUCTION IN OIL IMPORTS
  - DEVELOPMENT OF EXPORT INDUSTRY CAPABILITY.

  HOWEVER, RESIDENTIAL TAX CREDITS DO NOT PROVIDE THE TREASURY WITH OFFSETTING REVENUES, AS DOES THE BUSINESS ENERGY INVESTMENT CREDIT.

- IF WAGES CONTINUE TO ACCOUNT FOR APPROXIMATELY 40 PERCENT OF THE INSTALLED COST OF SOLAR AND WIND SYSTEMS, DOMESTIC RESIDENTIAL SYSTEM MANUFACTURE AND INSTALLATION WOULD REPRESENT OVER A $1 BILLION INDUSTRY. EMPLOYEES IN THE SOLAR INDUSTRY CAN, CORRESPONDINGLY, BE EXPECTED TO DOUBLE FROM TODAY'S LEVELS -- WHICH HAVE BEEN ESTIMATED TO BE 30,000 TO 40,000 WORKERS NATIONWIDE.

SUMMARY OF IMPLICATIONS

CONTINUING THE TAX CREDIT FOR INVESTMENT IN SOLAR/WIND TECHNOLOGIES WOULD:

- ENHANCE THEIR FINANCIAL ATTRACTIVENESS TO CONSUMERS, RAISING MARKET PENETRATION AND SUPPORTING THE DEVELOPMENT OF IMPROVED TECHNOLOGIES AT LOWER COST.
- MAINTAIN THE INDUSTRIAL BASE AND RELATED CONSUMER CONFIDENCE NECESSARY FOR SUCCESSFUL DEPLOYMENT OF SOLAR AND WIND TECHNOLOGIES AS THEY BECOME COST EFFECTIVE WITHOUT TAX CREDIT SUPPORT
- ENCOURAGE INVESTMENT IN A LABOR-INTENSIVE INDUSTRY WITH PROSPECTS FOR SIGNIFICANT PRODUCT EXPORT.
- PROVIDE INSTALLED SOLAR AND WIND ENERGY CAPACITY THAT IS CAPABLE OF REPLACING THE EQUIVALENT OF 33 MILLION BARRELS OF IMPORTED OIL ANNUALLY BY 1990.

THESE BENEFITS WOULD BE OBTAINED AT MINIMAL PRESENT VALUE COST TO THE GOVERNMENT DUE TO INCREASED FUTURE REVENUES THAT OFFSET NEAR-TERM COSTS. IN ADDITION, MAINTAINING A SMALL, VIABLE INDUSTRIAL BASE COMPLEMENTS FEDERAL R&D EFFORTS TO DEVELOP FUTURE GENERATIONS OF SOLAR/WIND TECHNOLOGIES.

centives it will be necessary to have State energy tax credits to make the commercialization a viable situation.

Mr. FUQUA. What would be the results of a simple extension of the tax credits to 15 percent?

Mr. BOS. In that case, the break-even point might be too far down. The value perceived by investors for their required rates of return after taxes would probably be too low for significant activities to continue, specifically in the solar thermal, large wind turbine and definitely in the photovoltaic technologies.

Some of these technologies are not as far along, in development as the small wind turbine farms which you presently see going up in California, and thus require further development over a longer time period for this breakeven to occur.

Mr. FUQUA. Mr. Schell, several times in our history, back right after World War II and more recently, we have attempted to develop a synthetic fuels industry in this country, and to see it disappear with the discovery of new oil fields and drop in oil prices, do you see that scenario happening again?

Mr. SCHELL. I certainly do. Right now I think we are in a position of grave indecision on the part of American industry as to whether it really wants to make the effort to develop a synthetic fuel industry, or an alternative energy industry of any kind, given the risk that they see in the environment.

I think all of us no longer see 2- and 3-percent real growth in oil prices, at least not for the next half dozen years or so. Certainly it is a finite resource and demand will pick up and we will again be in a difficult situation with oil and the importation of oil in this country potentially.

But the investment that is required is a long-term investment. It cannot be slave to near-term ups and downs in oil prices. It certainly cannot be influenced by oil prices and Federal Government policy, which is also wavering as our oil prices. If we are inconsistent at this level, I think it is very, very likely that we will have another fit and start in the synthetic fuel development that we have always wanted since even before that, in the early 1900's was the first effort, I believe.

Mr. FUQUA. I could not agree with you more. Do you think we will see a synthetic fuels industry emerge in this country in the 1990's?

Mr. SCHELL. I think a lot of it is going to depend on external factors, oil prices, and what people's forecasts are; not necessarily what they are today or tomorrow, but what people's forecasts for those are. I do think if we do find, as you pointed out, another big oil field in Alaska or off-shore somewhere, it hinders the development of a technology that we know we are going to need at some point. Whether that comes in the late 1980's or the 1990's, I do not know, but I think we are foolish if we do not make every effort to make sure it is here in the 1980's.

Mr. FUQUA. Mr. Bos, in your tables and charts that were accompanying your statement, you show curves with the cost of technologies coming down over the years. If we do not—I guess the question is, if we don't stimulate the market with tax incentives, will those cost decreases take place?

Mr. Bos. Mr. Chairman, they will not occur. They will probably follow the pessimistic scenario all the way to the point that no penetration will occur for some of these even though they potentially are economically viable in the long term.

Mr. FUQUA. Thank you, gentlemen, very much for being here this morning. We appreciate your statements and we may have questions that occur. If we do, we will get in touch with you in writing to respond to them. We thank you very much for being here this morning.

The meeting is adjourned.

[Whereupon, at 11:50 a.m., the subcommittee was adjourned, to reconvene subject to the call of the Chair.]

APPENDIX

ADDITIONAL STATEMENTS SUBMITTED FOR THE RECORD

STATEMENT OF THE HONORABLE CECIL "CEC" HEFTEL BEFORE THE SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

July 21, 1983

Mr. Chairman, I know I join many of our colleagues in commending you and the members of this Subcommittee for your leadership in promoting the full development and commercialization of renewable energy technologies in this country. Your hearings this month, the legislation that you have introduced, and the efforts that you have expended in the last Congress and the current Congress fully document your commitment to the realization of this important energy goal.

As you know, I have also introduced legislation to extend and expand the business energy tax credits for investment in alternative and renewable energy equipment. My bill, H.R. 3072, the Renewable Energy Incentive Act of 1983, has now attracted nearly 80 cosponsors in the House of Representatives. I believe that we share the view that this legislation is essential to continue to advance the development of our domestic renewable energy sources.

As the President continues his assault on Department of Energy programs and on the important gains that we have made in the area of renewable energy over the past several years, it is imperative that we maintain our support for these vital energy sources. Although we have been enjoying a brief period of relative plenty in terms of our national and worldwide energy supply, it is clear that another energy crisis, whether due to an embargo, a Middle East war, or other cause, is a very real possibility in the years ahead. If we learned nothing else from the embargo of the early 1970's, we learned how fragile our economy is and how reliant we are on imported energy from unstable foreign sources. The Renewable Energy Incentive Act of 1983 would provide the renewable energy industry with the assurance that tax incentives to encourage its continued growth would continue to be available through the decade of the eighties. This should provide sufficient time to allow commercialization of renewable technologies throughout the United States.

The Renewable Energy Incentive Act of 1983 would increase the business renewable energy tax credits--incentives for wind, ocean thermal energy, photovoltaics and other solar collectors, and geothermal energy development--from the current law level of 15 percent to 25 percent and extend eligibility for the new credit level through 1990. The 10 percent tax credit for biomass equipment is also extended through 1990, and the 10 percent credit for cogeneration equipment that expired in 1982 is revived and similarly extended.

This legislation also extends so-called affirmative commitments to renewable energy projects. Affirmative commitments assure companies that projects begun but not necessarily completed by 1990 will continue to be eligible for tax incentives after that date.

In addition, H.R. 3072 extends current law energy tax credits for residential installation of solar and wind energy equipment through 1990 and reverses a ruling by the Internal Revenue Service to provide that the regular 10 percent investment tax credit will be available for alternative energy property that is used to heat or cool an industrial or commercial building. Finally, this legislation will liberalize the availability of tax credits for ocean thermal energy conversion equipment and extend the 10 percent biomass credit to equipment used to produce methane gas by anaerobic digestion.

Although most of these tax credits do not expire until 1985, the time is now upon us to move to extend these vital energy incentives. In truth, it is now clear that we provided unrealistic sunset dates on these tax credits when we first enacted them. The uncertainty created for all investments by the deep recession and the substantial advance planning required for industrial and commercial projects utilizing alternative energy equipment demand that we now move quickly to correct our earlier error. It is crucial that both the renewable energy industry and potential investors in renewable equipment have the assurance that these tax incentives will be available through the 1980's.

The Renewable Energy Incentive Act of 1983 is an ambitious, comprehensive bill. No doubt, compromises will ultimately be necessary. But our energy supply and our economy are not so strong that we can afford to eliminate the only significant remaining targeted Federal incentive for renewable energy development. Moreover, the same compelling reasons that prompted Congress to enact the energy tax credits still exist today. Both the national economic costs of dependence on foreign oil and our ongoing U.S. strategic vulnerability to energy supply disruptions require that we continue to seek both near- and long-term solutions to our energy problems. We must not back away from our national effort to accelerate renewable energy development and commercialization.

Mr. Chairman, the Renewable Energy Incentive Act has the backing of every significant renewable energy organization and sends a clear signal to the investment community and to the country that Congress is not about to back down from its commitment to full scale renewable energy development.

I believe that you and this Subcommittee are owed a debt of gratitude for again taking the lead in conducting these substantive hearings on the need for renewable energy incentives. Now, we must turn our attention to the Ways and Means Committee, on which I serve, and to the rest of Congress, to see this legislation through to enactment. In an era of $200 billion annual deficits, this will not be an easy chore. But, the importance of this legislation to our country's energy future clearly merits our fullest attention.

DEPARTMENT OF THE TREASURY
WASHINGTON, D.C. 20220

DEPUTY ASSISTANT SECRETARY

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JUL 12 1983

Dear Mr. Chairman:

I am pleased to have the opportunity to convey to the Subcommittee on Energy Development and Applications of the Committee on Science and Technology the Administration's views concerning tax incentives for new energy technologies.

Current law

Under present law, solar, wind or geothermal property and ocean thermal property qualify for a 15 percent energy investment tax credit. In addition, biomass property qualifies for a 10 percent energy investment tax credit. Biomass generally includes animal waste, wood, sewage, sludge, oceanic and terrestial crops, and municipal and industrial waste. Biomass property is generally defined as equipment used to burn biomass as well as equipment used to convert biomass into a synthetic solid fuel. Equipment used to convert biomass into alcohol fuel also constitutes biomass property, but only where the primary source of energy for this equipment is neither oil, natural gas nor one of their byproducts.

Ten percent energy investment tax credits are also available for certain hydroelectric generating property and qualified intercity buses. The energy credits for the above mentioned categories of property terminate on December 31, 1985.

In general, the 10 percent energy investment tax credits on most other types of energy property expired on December 31, 1982 except for expenditures that qualified under the "affirmative commitment" rule. These include credits for equipment to produce synthetic fuel from alternate substances and coal conversion equipment and related equipment. In general, under the affirmative commitment rules, such property that is a part of a project with a normal construction period of two years or more qualifies for an energy credit up to December 31, 1990 if (i) before January 1, 1983, all engineering studies in connection with construction of the project have been completed and all environmental and construction permits have been applied for, and (ii) before January 1, 1986, the taxpayer has entered into binding contracts for the acquisition, construction or erection of equipment for the project that represents at least 50 percent of the estimated cost of the project.

Of course, in general, property eligible for the energy credits also qualifies for the regular 10 percent investment tax credit.

There is also available under current law an energy production credit for alternative fuel produced from non-conventional sources. The available credit is as much as $3 for each quantity of fuel equivalent to a barrel of oil in BTU terms. The credit applies to the following forms of energy production:

- Oil produced from shale and tar sands,
- Gas produced from geopressured brine, coal seams, biomass, Devonian shale or a tight formation,
- Liquid, gaseous or solid synthetic fuels or feedstocks produced from coal (including lignite),
- Fuel from qualifying processed wood, and
- Steam produced from solid agricultural byproducts.

In general, the production credit is allowed for qualifying energy that is sold after December 31, 1979 and before January 1, 2001 and that is derived from facilities placed in service after September 30, 1979 and before January 1, 1990. The credit generally phases out as the average wellhead price for domestic crude oil rises from $23.50 to $29.50 per barrel in 1979 dollars. The $3 credit and the $23.50 to $29.50 phaseout range are adjusted for inflation. In 1983 dollars these phaseout amounts are projected to be $31.42 and $39.44. The $3 value of the credit will be approximately $4 in 1983. Because of recent decreases in the price of oil, the credit for all alternative fuels, other than gas from Devonian shale, is currently available to taxpayers.

The production credit attributable to production from any particular facility is reduced proportionately by any subsidized energy financing, Federal, State and local grants and proceeds from industrial development bonds that are used to construct or acquire the facility or its equipment. The credit is also reduced, dollar-for-dollar, for any energy investment tax credit available with respect to property used in the project.

Effects of energy tax incentives

The Treasury Department to date has very little information on the degree of utilization of the tax incentives for the development and commercialization of new energy technologies. The latest year for which tax return data are available on the use of business energy tax credits by corporations is 1980. In that year, corporations claimed tentative energy tax credits of $400 million on about $4.0 billion of qualifying investments. Much of that investment, however, was expenditure on conventional technologies that were allowed energy tax credits because they were believed to contribute to reduced industrial use of oil and gas, either by burning other conventional fuels, such as coal and waste materials, or by conserving energy.

The business energy credits claimed by corporations are classified among 11 categories. The 3 categories with the largest amount of tax credits claimed -- alternative energy property, specially defined energy property, and recycling equipment -- accounted for $360 million, or 90 percent of the credits claimed. The remaining 10 percent was accounted for by the other 8 categories -- cogeneration equipment ($12 million), qualified inter-city buses ($10 million), geothermal equipment ($9 million), equipment for producing natural gas from geopressured brine ($4 million), hydroelectric property ($3 million), shale oil equipment ($3 million), solar and wind energy property ($1 million), and ocean thermal equipment (less than $0.5 million).

The data do not reveal what share of these 11 credits were for development of new energy technologies, as opposed to conventional technologies that were either in widespread use at the time the tax credits were introduced or that had been used in past years and had become uneconomic. The only categories that are known to consist mainly of new technologies are equipment for producing natural gas from geopressured brine, shale oil equipment, ocean thermal equipment, and possibly geothermal equipment and solar and wind property. Most of the other investments that are classified under the categories of specially defined energy property (mostly waste heat boilers), recycling equipment, cogeneration equipment, qualified intercity buses, and hydroelectric property -- over half of the investments for which credits were claimed -- generally represent investments in conventional technologies that had been developed and applied long before enactment of the 1978 Energy Tax Act and the Crude Oil Windfall Profit Tax Act of 1980.

It is unclear how much of the investment in alternative energy property -- one category that accounted for $160 million, or 40 percent of the tax credits claimed -- represents new technologies. The category of alternative energy property includes conventional coal burning plants used in electric generation and biomass equipment used for many years in the paper industry. However, it also includes credits for investment in new technologies, particularly for coal gasification equipment.

Business energy credits claimed by individuals in 1980 amounted to $23 million, or less than 6 percent of credits claimed by corporations. The Treasury Department has no data on the breakdown of business energy credits claimed by individuals among investment categories.

The data that show the volume of investment on which credits were claimed, and the amount of credits claimed, do not in themselves reveal how much additional investment in the subsidized property is attributable to the credits. It is extremely difficult to estimate the effect of the credits on investment, not only because data on actual use of the credit is limited, but also because available data do not permit accurate projections of how much investment would have taken place if the credits had not been available. There have been several attempts to study the effectiveness of the credit, either by questionnaire methods or by simulation based on theoretical models of industry investment behavior. The tentative conclusion of this research seems to be that the credits have had very little effect on investment in qualifying energy property. According to these studies, most of the investments for which credits were claimed would have been undertaken even if energy credits were not available.

Tax incentives are not justified

Even if the credits did substantially raise the number of alternative energy investments undertaken, that would not imply that the credits are desirable. We believe that to determine the desirability of any tax credit program it is necessary to examine the rationale underlying the tax incentives.

Tax incentives for specific investments are contrary to this Administration's general philosophy of relying on the free operation of markets to allocate resources efficiently and with the policy of relying on the market place rather than Federal intervention to determine patterns of energy use and production. If business investment is to be encouraged -- and certainly that has been a primary goal of this Administration -- then it should be encouraged through broad-based tax reduction. This, in fact, is what was accomplished by the Economic Recovery Tax Act when it reduced marginal tax rates across the board and introduced the

Accelerated Cost Recovery System ("ACRS"). The ACRS has removed general tax impediments to business investment, including investment now eligible for energy tax incentives. Compared to prior law, ACRS substantially reduces taxation of the return to equipment designed to produce alternative fuels.

At a 10 percent discount rate and for a corporation in the 46 percent tax bracket, the present value of tax savings from depreciation deductions and the regular investment credit on five year equipment is about 46 cents per dollar of investment -- the equivalent of the tax savings under expensing. The energy tax credits make the present value of tax saving per dollar of investment considerably more generous than expensing -- 54.1 cents per dollar for property eligible for a 10 percent energy credit and 58.2 cents per dollar for property eligible for a 15 percent energy credit. It should be noted that tax-exempt financing and other subsidies are also available for some investments that receive energy credits.

These specific energy incentives are different from ACRS in that they apply only to certain activities. Their effect is not so much to achieve a tax reduction as to introduce a tax differential among activities. Thus, energy tax incentives distort the allocation of resources, encouraging firms to undertake investments that are uneconomic at current and expected future market prices. They encourage users to purchase fuels that have a higher economic cost than alternative fuels because the tax system lowers the cost of the subsidized fuel. As a result, these incentives divert workers, capital, and initiative from more productive uses elsewhere in the economy and lower the net productivity of our nation's capital stock.

In 1978, at the time many of these energy tax incentives were enacted, price controls and supply allocations were in effect on both crude oil and natural gas and there was substantial resistance to decontrol. Because of price controls, business firms had insufficient incentive to invest in alternative energy sources. Therefore, in the absence of free market prices, an economic rationale existed for energy tax incentives. However, since the enactment of the energy credits, crude oil prices have been decontrolled and natural gas prices are being decontrolled and are approaching, and in some cases exceeding, free market levels. As a result, the tax credits, whatever their original justification, are no longer needed. Thus, our response to the question posed by the subcommittee regarding an appropriate level of tax subsidies to ensure the development of "viable" alternative energy industries is that no subsidy should be provided. Such industries should survive in the same economic climate as other competing industries.

Conclusion

Because we believe that special energy tax incentives are unwarranted. It is our view that the remaining energy tax incentives should be permitted to terminate as scheduled and that they should not be extended or enlarged. The Office of Management and Budget has advised that there is no objection from the standpoint of the Administration's program to the submission of this report to your Committee.

I appreciate the opportunity offered to us by the subcommittee to set out the Administration's views on this matter.

Sincerely,

J. Gregory Ballentine
Deputy Assistant Secretary
(Tax Analysis)

The Honorable
Don Fuqua, Chairman
Committee on Science and Technology
U.S. House of Representatives
Washington, D. C. 20515

WRITTEN TESTIMONY OF THE HONORABLE CARL T. CURTIS, MEMBER, BOARD OF DIRECTORS, ENERGY CYCLE, INC.
BEFORE THE SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
U. S. HOUSE OF REPRESENTATIVES
ON
TAX-INCENTIVES
FOR NEW ENERGY DEVELOPMENT
(H.R. 1775)

JULY 21, 1983

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FOR NEW ENERGY DEVELOPMENT
(H.R. 1775)

JULY 21, 1983

I. INTRODUCTION

GOOD MORNING. MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE, I AM MARK J. RIEDY, COUNSEL TO ENERGY CYCLE, INC., HEADQUARTERED IN LINCOLN, NEBRASKA, AND AN ATTORNEY IN SPRIGGS, BODE & HOLLINGSWORTH, A WASHINGTON, D.C. LAW FIRM. I SUBMIT THIS BRIEF WRITTEN TESTIMONY CONCERNING H.R. 1775, ENTITLED THE "RENEWABLE ENERGY TAX CREDIT ACT OF 1983," ON BEHALF OF THE HONORABLE CARL T. CURTIS, A FORMER UNITED STATES SENATOR, LONG-STANDING MEMBER OF THE SENATE COMMITTEE ON FINANCE AND CURRENT BOARD MEMBER OF ENERGY CYCLE, INC.

ENERGY CYCLE, INC. IS ONE OF FEW U.S. COMPANIES RECYCLING NONFOSSIL ORGANIC WASTES INTO ENERGY AND VALUABLE CO-PRODUCTS THROUGH A PROCESS OF ANAEROBIC DIGESTION. WITH ITS PATENTED ANAEROBIC DIGESTION SYSTEM, ENERGY CYCLE, INC.

BIOLOGICALLY FERMENTS THESE WASTES IN AIRTIGHT BIOMASS ENERGY EQUIPMENT TO PRODUCE BIOGAS. IN TURN, THIS BIOGAS, A BACTERIAL CREATION OF APPROXIMATELY 60 PERCENT METHANE-AND 40 PERCENT CARBON DIOXIDE-CONTAINING GAS IS CONVERTED INTO FUEL OR ELECTRICITY. UNLIKE NATURAL GAS, WHICH IS NON-RENEWABLE, METHANE IS A PARTICULARLY VALUABLE ALTERNATE ENERGY SOURCE BECAUSE IT IS RENEWABLE AND BECAUSE, ON THE BASIS OF BTU CONTENT, IT IS AN APPROXIMATE SUBSTITUTE FOR NATURAL GAS.

II. POSITION

A. STATUS OF THE ANAEROBIC DIGESTION INDUSTRY

WE WELCOME THIS OPPORTUNITY TO PRESENT TO THIS DISTINGUISHED HOUSE PANEL OUR VIEWS, SUPPORTING IN CONCEPT THE EXTENSION OF THE QUALIFICATION PERIOD FOR THE UTILIZATION OF THE ENERGY INVESTMENT TAX CREDIT FOR CERTAIN ENERGY PROPERTY (I.E., "SOLAR, WIND, OR GEOTHERMAL" AND "OCEAN THERMAL" PROPERTY) PROPOSED IN H.R. 1775. BEFORE DISCUSSING THE BREADTH OF THIS BILL AND ITS IMPACT ON ANAEROBIC DIGESTION, WE WILL HIGHLIGHT THE PRESENT AND PROJECTED STATUS OF THIS INDUSTRY.

1. THE AGRICULTURAL AND MUNICIPAL MARKETS

THE ANAEROBIC DIGESTION INDUSTRY PRIMARILY GENERATES REVENUES THROUGH TWO PRINCIPAL INDUSTRY SEGMENTS: 1) THE AGRICULTURAL MARKET AND 2) THE MUNICIPAL MARKET.

IN THE AGRICULTURAL MARKET, ANAEROBIC DIGESTER SYSTEMS ARE UTILIZED IN THE TREATMENT OF ANIMAL WASTE AND FOOD PROCESSING RESIDUES. THE POTENTIAL MARKET PRIMARILY INCLUDES DAIRY, BEEF, POULTRY, SWINE, CHEESE WHEY, AND CANNERY OPERATIONS. PRESENTLY, THIS MARKET SEGMENT INCLUDES ONLY THIRTEEN COMPANIES COMMERCIALLY MARKETING METHANE DIGESTERS. FROM THE DESIGN AND CONSTRUCTION OF DIGESTER SYSTEMS FOR THIS MARKET SEGMENT, WE ESTIMATE THAT 1982 SALES APPROACHED $3.7 MILLION WHILE 1990 SALES COULD AMOUNT TO OVER $235.35 MILLION.

IN THE MUNICIPAL MARKET, ANAEROBIC DIGESTION SYSTEMS ALREADY ARE PREVALENT IN THE TREATMENT OF HUMAN WASTE. THESE SYSTEMS CONVERT SEPTIC TANK WASTES INTO A COMMERCIALLY SALEABLE FERTILIZER PRODUCT. PRESENTLY, ONLY ONE COMPANY CONTROLS THE COMMERCIAL MARKETING OF ANAEROBIC DIGESTERS FOR MUNICIPALITIES. FROM THE DESIGN AND CONSTRUCTION OF DIGESTER SYSTEMS FOR THIS MARKET SEGMENT, WE ESTIMATE THAT 1982 SALES APPROACHED $2 MILLION WHILE 1990 SALES COULD EXCEED $300 MILLION.

TO GROW BEYOND THE CURRENT MODEST SALES LEVELS FOR AND TO PROMOTE COMPETITION WITHIN THE AGRICULTURAL AND MUNICIPAL MARKETS, THE ANAEROBIC DIGESTION INDUSTRY MUST BE ACCORDED ENERGY INVESTMENT TAX CREDITS.

IN THE AGRICULTURAL MARKET, THE GROWTH OF THIS INDUSTRY WILL BE SIGNIFICANTLY AFFECTED BY ITS ABILITY TO DEVELOP SYSTEMS THAT ARE ECONOMICALLY VIABLE FOR SMALLER SIZE FARMS. IN ADDITION TO TECHNOLOGICAL IMPROVEMENTS, THE ABILITY TO UTILIZE A 10 PERCENT ENERGY INVESTMENT TAX CREDIT IN THE FIRST YEAR OF A DIGESTER'S OPERATION COULD DETERMINE ITS FEASIBILITY FOR SMALL SCALE FARMS.

IN THE MUNICIPAL MARKET, THE PURCHASERS OF ANAEROBIC DIGESTION SYSTEMS FOR MUNICIPAL WASTE TREATMENT PLANTS OFTEN HAVE BEEN TAX EXEMPT INSTITUTIONS. THUS, THE IMPACT OF AN ENERGY INVESTMENT TAX CREDIT IN THOSE SITUATIONS IS NON-EXISTENT. NEVERTHELESS, IN RECENT YEARS, PRIVATELY OWNED FINANCE PARTNERSHIPS HAVE DEVELOPED TO ASSIST MUNICIPALITIES MEET THEIR GROWING FINANCIAL NEEDS. THE PARTNERSHIPS CONSTRUCT WASTE TREATMENT SYSTEMS WITH PRIVATE SECTOR DOLLARS AND LEASE THEM BACK TO MUNICIPALITIES AT REASONABLE RATES. IN THESE TAX LEASE ARRANGEMENTS, THE PARTNERSHIPS WOULD BENEFIT FROM THE TAX CREDITS AND ACCELERATED DEPRECIATION ALLOWANCES ASSOCIATED WITH SUCH AN INVESTMENT. ON THE OTHER HAND, MUNICIPALITIES WOULD OBTAIN A CONVENIENT SOURCE

OF FINANCIAL ASSISTANCE. HERE, THE IMPACT OF AN ENERGY TAX CREDIT ON THESE ARRANGEMENTS WOULD BE SIGNIFICANT.

2. ECONOMIC, ENVIRONMENTAL AND POLITICAL SIGNIFICANCE

THE DEVELOPMENT OF THE ANAEROBIC DIGESTION INDUSTRY CAN PROVIDE SIGNIFICANT BENEFITS TO THE UNITED STATES IN TERMS OF ECONOMIC, ENVIRONMENTAL, AND POLITICAL WELFARE.

ECONOMICALLY, THE GROWTH OF THE INDUSTRY SIGNALS BENEFITS BOTH THROUGH THE REVENUES GENERATED FROM DIGESTER SALES AND THROUGH THE POTENTIAL ECONOMIC SALVATION IT MAY PROVIDE FOR THE HARD HIT AGRICULTURAL SECTOR OF THE ECONOMY. ANAEROBIC DIGESTION MAY PROVIDE AN ADDITIONAL CASH CROP THAT COULD PERMIT SURVIVAL FOR MANY MARGINAL FARM OPERATIONS. ADDITIONALLY, THE CREATION OF NEW EMPLOYMENT OPPORTUNITIES FOR OUR NATION'S HARD PRESSED UNEMPLOYED CITIZENS THROUGH A VIBRANT ANAEROBIC DIGESTION INDUSTRY WOULD DECREASE ECONOMIC SUFFERING AND ENHANCE THE FISCAL VITALITY OF THE UNITED STATES.

ENVIRONMENTALLY, ANAEROBIC DIGESTION PROVIDES BENEFITS THROUGH THE PROPER TREATMENT AND DISPOSAL OF AGRICULTURAL AND MUNICIPAL WASTES. THIS TREATMENT IS ESPECIALLY IMPORTANT FOR OPERATIONS CLOSE TO POPULATION CENTERS OR WATER

FACILITIES. IT ELIMINATES NOXIOUS ODORS AND REDUCES THE DANGER OF WATER POLLUTION.

FINALLY, THE POLITICAL IMPLICATIONS OF A VIABLE ANAEROBIC DIGESTION INDUSTRY ARE POTENTIALLY SIGNIFICANT. THE DEGREE TO WHICH OUR AGRICULTURAL SECTOR BECOMES ENERGY SELF-SUFFICIENT MAY WELL GUARANTEE OUR FOOD SUPPLY DURING TIMES OF NATIONAL EMERGENCY [illegible] EXTERNAL ENERGY SOURCES ARE INTERRUPTED OR CUT-OFF.

B. H.R. 1775

CONGRESS HAS COMMITTED ITSELF TO THE DEVELOPMENT OF RENEWABLE ALTERNATE ENERGY SOURCES THROUGH INCENTIVE-BASED LEGISLATION TO INSURE A STRONG AND CONTINUED INDEPENDENT BASE OF ENERGY FOR THE UNITED STATES. THE ANAEROBIC DIGESTION INDUSTRY, IN ITS RECYCLING OF NONFOSSIL ORGANIC WASTES INTO RENEWABLE ALTERNATE ENERGY, CLEARLY FALLS WITHIN THE INTENDED SCOPE OF THIS COMMITMENT. NEVERTHELESS, THROUGH INADVERTENCE AND DESPITE ITS CLEAR INTENT TO THE CONTRARY, CONGRESS HAS NOT EXPRESSLY ENCOURAGED INVESTMENT INTO THIS INDUSTRY THROUGH ENERGY INVESTMENT TAX INCENTIVE LEGISLATION. THESE CREDITS ARE ESSENTIAL TO THE VITALITY OF THIS NASCENT INDUSTRY.

H.R. 1775 NOTABLY ATTEMPTS TO EXTEND ENERGY TAX INCENTIVES FOR THE BENEFIT OF CERTAIN ALTERNATE ENERGY TECHNOLOGIES.

H.R. 1775 was introduced by Congressman Fuqua on March 2, 1983, along with Congressman Lujan.[1] H.R. 1775 would amend Section 46(a)(2)(C)(i) of the Internal Revenue Code of 1954, as amended (Code),[2] to increase the energy investment tax credit for "solar, wind, or geothermal" and "ocean thermal" property from 15 to 25 percent and extend this credit through December 31, 1990.[3] Further, it would amend Section 46(a)(2)(C) of the Code to include a new "affirmative commitments" provision for this specific property.[4]

Through its affirmative commitments provision, H.R. 1775 would extend the availability of the renewable energy tax credit for this property to December 31, 1994, for those taxpayers who make certain demonstrable commitments to renewable energy projects before January 1, 1991 and January 1, 1993. Thus, to demonstrate the requisite affirmative commitments, a taxpayer project sponsor first must complete all feasibility studies and apply for all environmental and construction permits before January 1, 1991. Secondly, a sponsor must execute contracts for at least 50 percent of the reasonably estimated cost of all equipment for the project or 50 percent of the reasonably estimated cost of that equipment specially designed for the project before January 1, 1994.[5]

NEVERTHELESS, H.R. 1775'S EXPRESS LANGUAGE DOES NEITHER ADDRESS BIOMASS PROPERTY NOR INCLUDE THE ANAEROBIC DIGESTION INDUSTRY FOR PURPOSES OF THE CRITICAL ENERGY INVESTMENT TAX CREDIT. THIS INCLUSION REPRESENTS THE MOST SIGNIFICANT HURDLE FACING THIS INDUSTRY.

ENERGY CYCLE, INC. SUPPORTS THE CONCEPT ADVANCED IN THIS PROPOSED LEGISLATION. NEVERTHELESS, WE BELIEVE THAT H.R. 1775 IS MUCH TOO NARROW IN SCOPE. IN ITS PRESENT FORM, THE BILL DOES NOT GO AS FAR AS IT SHOULD TOWARD PROMOTING THE PUBLIC POLICY GOALS OF ENCOURAGING THE BROADEST POSSIBLE PROMOTION OF ALTERNATE ENERGY SOURCES. SPECIFICALLY, WE RECOMMEND THAT THE BILL INCLUDE ENERGY INVESTMENT TAX INCENTIVES FOR THE ANAEROBIC DIGESTION INDUSTRY.

C. ENERGY INVESTMENT TAX CREDITS ON BIOMASS PROPERTY

UNDER THE ENERGY TAX ACT OF 1978, PUB. L. NO. 95-618,[6] CONGRESS ESTABLISHED THROUGH DECEMBER 31, 1982 A 10 PERCENT ENERGY INVESTMENT TAX CREDIT FOR BOILERS, BURNERS, AND RELATED POLLUTION CONTROL AND FUEL HANDLING EQUIPMENT WHICH PRIMARILY UTILIZE FUELS OTHER THAN OIL OR NATURAL GAS (I.E., "ALTERNATE SUBSTANCE").[7] EQUIPMENT EMPLOYED TO CONVERT THESE ALTERNATE SUBSTANCES INTO A "SYNTHETIC LIQUID, GASEOUS, OR SOLID FUEL" ALSO WAS MADE ELIGIBLE FOR THE CREDIT.[8] ALTHOUGH NOT EXPRESSLY MENTIONED, CONGRESS CLEARLY INTENDED

PROPERTY USING BIOMASS FUELS TO QUALIFY FOR THE CREDIT AS "ENERGY PROPERTY" WITHIN THE DEFINITION OF "ALTERNATE ENERGY PROPERTY."[9]

UNDER THE WINDFALL PROFITS TAX ACT OF 1980, PUB. L. NO. 96-223,[10] CONGRESS CONTINUED THIS 10 PERCENT ENERGY INVESTMENT TAX CREDIT FOR THIS SPECIFIC PROPERTY AND EXTENDED THE CREDIT'S QUALIFICATION PERIOD THROUGH DECEMBER 31, 1985.[11] IT ALSO EXPRESSLY DESIGNATED A 10 PERCENT ENERGY CREDIT FOR BIOMASS ALTERNATE ENERGY PROPERTY.[12]

IN THE CONFERENCE REPORT TO THE WINDFALL PROFITS TAX ACT, CONGRESS EXPLICITLY OUTLINED THE SCOPE IT INTENDED FOR THE TERM "BIOMASS."[13] THERE, CONGRESS PROVIDED THAT

> BIOMASS IS GENERALLY ANY ORGANIC SUBSTANCE OTHER THAN OIL, NATURAL GAS OR COAL, OR PRODUCT OF OIL OR NATURAL GAS OR COAL. FOR THIS PURPOSE, BIOMASS INCLUDES WASTE, SEWAGE, SLUDGE, GRAIN, WOOD, OCEANIC AND TERRESTRIAL CROPS AND CROP RESIDUES AND INCLUDE WASTE PRODUCTS WHICH HAVE A MARKET VALUE. THE CONFEREES ALSO INTEND THAT THE DEFINITION OF BIOMASS DOES NOT EXCLUDE WASTE MATERIALS, SUCH AS MUNICIPAL AND INDUSTRIAL WASTE, WHICH INCLUDE SUCH PROCESSED PRODUCTS OF

> OIL, NATURAL GAS OR COAL SUCH AS USED PLASTIC CONTAINERS AND ASPHALT SHINGLES.[14]

CLEARLY, ANAEROBIC DIGESTION EQUIPMENT FALLS WITHIN THE CONGRESSIONALLY INTENDED SCOPE OF QUALIFIED BIOMASS PROPERTY.

DESPITE THE INTENT OF CONGRESS SO PLAINLY EXPRESSED IN THE CONFERENCE REPORT, THE STATUTORY LANGUAGE USES THE TERM "QUALIFIED FUEL" INSTEAD OF THE PHRASE "SYNTHETIC LIQUID, GASEOUS, OR SOLID FUEL" TO DEFINE ELIGIBLE BIOMASS ALTERNATE ENERGY CONVERSION EQUIPMENT[15] AND INADVERTENTLY DEFINES "QUALIFIED FUEL" IN A MANNER INCONSISTENT WITH ITS CLEARLY EXPRESSED CONGRESSIONAL INTENT. SPECIFICALLY, CONGRESS DEFINED "QUALIFIED FUEL" AT SECTION 48(L)(15)(C) OF THE CODE AS

> (I) ANY SYNTHETIC SOLID FUEL, AND
> (II) ALCOHOL FOR FUEL PURPOSES IF THE PRIMARY SOURCE OF ENERGY FOR THE FACILITY PRODUCING THE ALCOHOL IS NOT OIL OR NATURAL GAS OR A PRODUCT OF OIL OR NATURAL GAS.[16]

THIS RESTRICTIVE DEFINITION DOES NOT EXPRESSLY INCLUDE METHANE-CONTAINING GAS FOR FUEL OR ELECTRICITY, PRODUCED BY ANAEROBIC DIGESTION FROM NONFOSSIL WASTE MATERIALS. FOR

THAT REASON, DESPITE THE CONGRESS' ULTIMATE AIM AS EXPRESSED SO CLEARLY IN THE CONFERENCE REPORT, ANAEROBIC DIGESTION EQUIPMENT CONVERTING AN ALTERNATE SUBSTANCE (I.E., NONFOSSIL ORGANIC WASTES) INTO BIOMASS-DERIVED METHANE-CONTAINING GAS HAS BEEN INTERPRETED AS NOT QUALIFYING FOR THE ENERGY INVESTMENT TAX CREDIT. UNFORTUNATELY, H.R. 1775 DOES NOT REMOVE THE CONFUSION THAT CURRENTLY SURROUNDS THE ELIGIBILITY OF ANAEROBIC DIGESTION PROPERTY FOR ENERGY INVESTMENT TAX CREDIT PURPOSES.

IN 1982, CONGRESSMAN BEREUTER AND SENATOR MATSUNAGA -- WITH CO-SPONSORS SENATORS WALLOP AND GRASSLEY -- INTRODUCED H.R. 6131 (ON APRIL 21)[17] AND S. 2766 (ON JULY 21),[18] RESPECTIVELY, CONFIRMING WHAT HAS BEEN CONGRESS' INTENTION ALL ALONG -- NAMELY, THAT ANAEROBIC DIGESTION EQUIPMENT BE ELIGIBLE FOR APPROPRIATE TAX CREDITS. THOSE IDENTICALLY-DRAFTED BILLS WOULD HAVE INCLUDED THIS METHANE-CONTAINING GAS AS A QUALIFIED FUEL. SIMILARLY, THEY WOULD HAVE PERMITTED ANAEROBIC DIGESTION EQUIPMENT, PLACED IN SERVICE AFTER DECEMBER 31, 1982, TO OBTAIN THE 10 PERCENT ENERGY INVESTMENT CREDIT. REGRETABLY, BECAUSE OF THE PRESS OF OTHER EVENTS, CONGRESS TOOK NO ACTION ON THOSE PROPOSED MEASURES IN 1982.

ON MARCH 3, 1983, CONGRESSMEN BEREUTER AND HEFTEL REINTRODUCED CONGRESSMAN BEREUTER'S 1982 MEASURE AS H.R. 1876.[19] ON MAY 17 AND 19, 1983, RESPECTIVELY, SENATOR PACKWOOD AND CONGRESSMAN HEFTEL INTRODUCED S. 1305[20] AND H.R. 3072,[21] BOTH ENTITLED THE "RENEWABLE ENERGY INCENTIVE ACT OF 1983." S. 1305 AND H.R. 3072 INCLUDE THE ANAEROBIC DIGESTER LANGUAGE OF H.R. 1876 IN SLIGHTLY DIFFERENT WAYS.[22] UNLIKE H.R. 1775, THEREFORE, BOTH OF THE FOREGOING OMNIBUS ENERGY TAX INCENTIVE PACKAGES WOULD QUALIFY ANAEROBIC DIGESTER EQUIPMENT FOR THE 10 PERCENT ENERGY INVESTMENT TAX CREDIT THROUGH THEIR INCLUSION OF METHANE-CONTAINING GAS AS A QUALIFIED FUEL FOR PURPOSES OF DEFINING ELIGIBLE BIOMASS PROPERTY.

BOTH S. 1305 AND H.R. 3072, UNLIKE H.R. 1775, WOULD EXTEND THE 10 PERCENT BIOMASS PROPERTY CREDIT FROM DECEMBER 31, 1985 THROUGH DECEMBER 31, 1990.[23] ALSO, S.1305 AND H.R. 3072, UNLIKE H.R. 1775, WOULD EXTEND THE ENERGY CREDIT FOR BIOMASS PROPERTY TO DECEMBER 31, 1995, UPON THE COMPLETION OF CERTAIN AFFIRMATIVE COMMITMENTS SIMILAR TO THOSE IN H.R. 1775.[24]

III. CONCLUSION

THIS SUBCOMMITTEE TODAY HAS THE SPECIAL OPPORTUNITY TO ENTHUSIASTICALLY CONFIRM THE CLEAR AND LONG-STANDING CONGRESSIONAL INTENT TO QUALIFY ANAEROBIC DIGESTION EQUIPMENT FOR THE 10 PERCENT ENERGY INVESTMENT TAX CREDIT AND, THUS, PROMOTE THE PRODUCTION AND DEVELOPMENT OF CRITICAL ALTERNATE ENERGY SOURCES. IT CAN INCLUDE QUALIFYING LANGUAGE IN H.R. 1775 OR SUPPORT S. 1305 OR H.R. 3072 TO ACCOMPLISH THIS IMPORTANT RESULT.

A TAXPAYER ENGAGED IN AGRICULTURE USUALLY MUST SECURE THIRD-PARTY FINANCING IN ORDER TO INSTALL AN ANAEROBIC DIGESTER SYSTEM. THE APPLICATION OF THE ENERGY CREDIT TO THIS SYSTEM MAKES THIRD-PARTY FINANCING POSSIBLE. WITHOUT THE ENERGY CREDIT, THIS ALTERNATE ENERGY SOURCE WILL NOT BE UTILIZED TO ANY GREAT EXTENT.

THE SHORT TERM EFFECT ON GOVERNMENT REVENUES THROUGH THE USE OF THESE CREDITS BY THE ANAEROBIC DIGESTION INDUSTRY WILL BE MINIMAL. THE AVAILABILITY OF THESE ENERGY CREDITS FOR ANAEROBIC DIGESTER SYSTEMS WILL ENCOURAGE STRONG INVESTMENT INTO THE INDUSTRY. THUS, INVESTMENT-GENERATED INDUSTRY SALES WILL PROVIDE INCREASINGLY SIZABLE LONG-TERM TAXABLE INCOME FOR THE GOVERNMENT'S COFFERS.

THE ECONOMIC, ENVIRONMENTAL AND POLITICAL SIGNIFICANCE OF THE ANAEROBIC DIGESTION INDUSTRY TO THE CITIZENS OF THE UNITED STATES ARGUES IN FAVOR OF OUR RECOMMENDED CHANGES IN H.R. 1775. SIMILARLY, THE IDENTICAL CONGRESSIONAL OVERSIGHT THAT EXCLUDED AN ANAEROBIC DIGESTER SYSTEM FROM THE ENERGY INVESTMENT TAX CREDIT ALSO EXCLUDED ANOTHER IMPORTANT ALTERNATIVE ENERGY TECHNOLOGY, I.E., WOOD GASIFICATION, FROM THAT CREDIT. AS SUCH, A TECHNICAL CORRECTION TO THE TAX CODE TO ELIMINATE THE ADVERSE EFFECTS OF THIS OVERSIGHT IS CRITICALLY IMPORTANT.

FOOTNOTES

[1] H.R. 1775, 98th Cong., 1st Sess., 129 CONG. REC. H 774 (1983).

[2] 26 U.S.C. §§ 1 *et seq.*

[3] Section 2(a) of H.R. 1775 amending 26 U.S.C. § 46(a)(2)(C)(i).

[4] Section 2(b)(1) of H.R. 1775 amending 26 U.S.C. § 46(a)(2)(C)(v).

[5] *Id.*

[6] 26 U.S.C. § 1 note *et seq.*

[7] Section 301 of Pub. L. No. 95-618 amending 26 U.S.C. §§ 46, 48; H.R. CONF. REP. No. 817, 96th Cong., 2d Sess. 131-132 (1980) (Crude Oil Windfall Profits Tax Act of 1980).

[8] Section 301 of Pub. L. No. 95-618 amending 26 U.S.C. § 48; H.R. CONF. REP. No. 817, *supra*.

[9] *Id.*

[10] 26 U.S.C. § 1 note *et seq.*

[11] Section 221 of Pub. L. No. 96-223 amending 26 U.S.C. § 46(a)(2)(C)(i); H.R. CONF. REP. No. 817, *supra* at 132.

[12] *Id.*

[13] H.R. CONF. REP. No. 817, *supra* at 132.

[14] *Id.*

[15] 26 U.S.C. § 48(l)(15)(B)(ii).

[16] *Id.* at § 48(l)(15)(C).

[17] H.R. 6131, 97th Cong., 2d Sess. (1982).

[18] S. 2766, 97th Cong., 2d Sess. (1982).

[19] H.R. 1876, 98th Cong., 1st Sess. (1983).

[20] S. 1305, 98th Cong., 1st Sess. (1983). Co-sponsors include Senators Matsunaga, Durenberger, Moynihan, Baucus, Mitchell, and Pell.

[21] S. 3072, 98th Cong., 1st Sess. (1983). Co-sponsors include Congressmen Fowler, Matsui, Duncan, Flippo, Fuqua, Udall, Ottinger, Fish, Mineta, Corrada, Jeffords, Wyden, Williams, Wirth, Bedell, Wolpe, Harkin, Bereuter and Long; and Congresswomen Kennelly and Schneider.

[22] Section 7 of S. 1305 and Section 201 of H.R. 3072 amending 26 U.S.C. § 48(l)(15)(C). Section 7 of S. 1305 would include as a "qualified fuel" "methane-containing gas for fuel or electricity, produced by anaerobic digestion from nonfossil waste materials at farms or other agricultural facilities, and at facilities for the first processing of agricultural products." In slightly different language, Section 201 of H.R. 3072 would include as a "qualified fuel" "methane-containing gas, for fuel or electricity, produced by anaerobic digestion from nonfossil waste materials."

[23] *Compare* Section 3 of S. 1305 and Section 101(a) of H.R. 3072 amending 26 U.S.C. § 46(a)(2)(C)(i) *with* Section 2(a) of H.R. 1775.

[24] *Compare* Section 4 of S. 1305 and Section 101(b) of H.R. 3072 amending 26 U.S.C. § 46(a)(2)(C) to add new subsection (iv) *with* Section 2(b)(1) of H.R. 1775.

STATEMENT OF DR. EDWARD H. BLUM

VICE PRESIDENT & EXECUTIVE DIRECTOR
ALTERNATIVE ENERGY FINANCING
MERRILL LYNCH WHITE WELD CAPITAL MARKETS GROUP

SUBMITTED FOR THE RECORD
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S HOUSE OF REPRESENTATIVES

JULY 22, 1983

HIGHLIGHTS

- In our experience financing alternative energy firms and projects, the business energy tax credits (ETC) have proved effective and essential.

- Investors can choose from a large menu of investment alternatives. To attract them to invest in alternative energy requires a rate of return considerably higher than that available from conventional securities, to compensate for (a) the perceived technology risks, (b) uncertainties about future energy prices, and (c) the illiquidity of project investments.

- In today's market, A-rated 30-year tax-exempt bonds yield 10%. To compete, alternative energy investments generally must offer 20% to 30% rates of return after-tax. The higher rates are generally needed for newer technologies.

- The ETC is essential to provide the needed after-tax rate of return. It is the key to transforming projects that are merely economic (e.g., offering the median return on equity for the top 1000 U.S. firms) into ones that can attract the necessary risk capital.

- R&D, tooling, manufacturing, project development, installation, and operation take time. Thus the ETC's impact is only now becoming conspicuous. During 1982 and the first half of 1983, for example, wind projects have burgeoned -- particularly in California, where state tax benefits augment the ETC to provide individual investors the after-tax equivalent of a 30% ETC. Only a few projects were operating before June 1982; since then, over $200 million in projects have been installed, and at least $150 million more are reported now to be in the financing pipeline.

- The large market the ETC helps to stimulate is inducing R&D and the use of new technologies. For example, new wind-turbines are being developed by numerous manufacturers of all sizes. Costs are declining and performance is improving. With an extended ETC, prospects are quite strong that the technology will be cost-effective without the ETC in the next five years.
- At a 30% after-tax rate of return, the ETC makes the after-tax cost of renewable energy investments equivalent to that of expensing under current tax law. Without the ETC, renewable energy investments are treated inequitably. Extending the ETC is thus important to continuing tax equity.
- The ETC works through the free-market, effectively fostering technological development and use important to U.S. energy security and high-technology economic development.

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U.S. HOUSE OF REPRESENTATIVES

JULY 22, 1983

Mr. Chairman and Members of the Committee: It is a pleasure to submit for the record this statement in support of legislation to extend the business energy tax credits for energy technologies.

My name is Edward H. Blum. I am a Vice President of Merrill Lynch, Pierce, Fenner & Smith and Executive Director of Alternative Energy Financing in the Merrill Lynch White Weld Capital Markets Group, the investment banking arm of Merrill Lynch. My colleagues and I are actively financing the development and use of a wide range of alternative energy technologies, including solar, wind, geothermal, hydroelectric, cogeneration and biomass.

In our experience to date, the business energy tax credits have proven effective and essential. I would like to share this experience with you, provide some illustrative numbers and details, and address some of the substantive issues raised about extending the tax credits in the debate thus far.

RENEWABLE ENERGY MARKETPLACE

I would like to begin by noting a few key points about the marketplace for renewable and cogenerated energy. These outline the context within which financing must take place.

First, it is worth emphasizing that conventional forms of renewable energy are already important in the United States economy, and that less conventional forms hold the potential of supplying very large quantities of energy in the U.S. and abroad by the end of this century. Official statistics do not adequately cover renewable energy. But generally accepted estimates are that wood and hydroelectricity together now contribute the equivalent of roughly 2.5 million barrels of oil per day, over six percent of total U.S. energy use, with much smaller but rapidly growing contributions from geothermal, wind and direct uses of solar energy. Estimates of future use vary widely. The potential, however, is clearly large. Many studies show the possibility that renewable sources might provide over 20% of the total U.S. energy supply, and even larger percentages of the supply for countries less well endowed with oil, gas, coal, oil shale, and uranium.

How extensively renewable energy technologies are and will be used is largely determined by the quality of the technologies (that is, their ability to convert natural energy into useful forms reliably and effectively) and by competitive economics. An important dimension of quality is successful experience. Many renewable energy technologies are new and rapidly improving, with some but still limited experience to date, little of it as yet well documented. As a result, investors still see them as risky. To move them into the marketplace, especially in the absence of an independent testing or verification program, thus requires offering investors a "risk-premium" -- a rate of return higher than that available on more conventional investments.

This relation between risk and reward is well established and very clear in the bond markets, where the rating agencies evaluate and attempt to quantify risk into specific categories. For example, on July 13, 1983, the prices of 30-year Treasury bonds provided investors a return of 11.42%, but new 30-year electric utility bonds rated Aaa (the best rating) had to be priced to offer interest rates of 12.4% to 12.55%; new 30-year electric utility bonds rated Baa (the lowest investment-grade rating) had to offer 13.15% to 13.65% to attract buyers.

Investments involving new technologies are not generally rated so formally. But investors' perceptions and demands for higher returns to offset perceived risks are quite similar. The principal difference is that the returns they demand for risky project financings are much higher than those for rated bonds.

Second, it is worth noting that, despite moves toward deregulation, the overall market for energy is not perceived to be a free marketplace. Internationally, oil prices are still influenced by third-world and Soviet Union production decisions. This influence is not as great now as it has been in the past. But the recent wide swings in oil prices and the considerable uncertainty about future prices add to the sense of risk and complicate and hinder decisions about alternative energy supplies. Domestically, producers of traditional fuels (e.g., oil, gas, coal and uranium) have obtained tax treatment for the costs of extraction and for depletion that continues to be important in stimulating production and in obtaining the needed capital. Federal and State regulation continue to control the prices of natural gas and electricity.

Moreover, expenditures for fuels used in business constitute operating costs, deductible from revenues in computing income taxes. Renewable energy sources are generally not purchased from someone else. Capturing the river, the wind or direct solar energy substitutes capital investment for the continuing expense of fuel. Tax incentives for renewable energy capital investments provide equitable balance, partly offsetting the tax advantage of fuel expensing.

FINANCING EXPERIENCE

The business energy tax credit (ETC) was originally enacted in November, 1978, and the current renewable ETC dates from mid-1980. Substantial projects take over two years to conceive, design and build. And technologies not previously in widespread use often require several years to evolve through research and development (R&D) into the marketplace. Therefore, the impact of the business renewable energy tax credit is becoming visible only now.

The growth of the wind industry during 1982 and the first half of 1983 illustrates this important point. Following the Energy Tax Act of 1978, many firms began extensive R&D to improve then-existing windturbines. By 1981, several firms had begun to build production facilities; others began production in 1982. During the same period, several states with good wind resources implemented the Public Utilities Regulatory Policy Act (PURPA), also enacted in November 1978, in ways that encouraged so-called third-party financing through independent power producers.

By late 1981, a few wind farms began to be installed. By early 1982, the financial community began to be educated in this new area, and substantial installations were begun. For several reasons -- the good wind resources, a public utilities commission with a favorable policy toward renewable energy, cooperative utilities with relatively high "avoided costs," and state tax benefits augmenting the ETC -- much of this development occurred in California. Development became so vigorous, for example, that in Kern County, California, wind farms were the primary construction activity and employer during 1982.

Before June 1982, virtually no wind project financing had been done by any investment or commercial bank. Since then, Merrill Lynch alone has raised over $80 million in equity for wind projects totalling over $130 million. Entrepreneurs and other investment banks have raised at least another $50 million for wind projects totalling over $70 million, also during the past 14 months. Over $150 million more such financing is reportedly now in the financing pipeline.

The period between initial enactment of the tax credits and the takeoff of this industry represents an unavoidable incubation period. Time is always essential to develop a technology to the point where it is commercially acceptable, and to complete the contractual arrangments needed for successful project financing.

All this activity in California is a direct consequence of the ETC and of the corresponding California solar and wind business energy tax credit which (net of Federal taxes on the reduced state tax liability) is worth 12.5 percent to an individual investor. These combined tax credits are equivalent to a Federal credit of 27.5 percent; state depreciation increases the total tax benefits to the equivalent of a 30 percent Federal tax credit. Together, the Federal and state tax incentives are fostering the growth of what many expect to be a substantial industry. This industry is growing as a result of the ETC, and would definitely not have grown without it.

One might reasonably ask: Can it be a healthy industry, one that will survive, if it needs such large stimuli to get started? The answer, thus far at least, appears to be "Yes." Even over the past 14 months, those of us active in the field have observed notable improvements in performance and cost-efficiency.

As production runs lengthen, costs are decreasing. As installed windturbines accumulate experience, designs are being improved to enhance performance. And, having learned from producing and operating this first generation of modern, commercial windturbines, engineers are now scaling up. Having become comfortable with 25, 50, and 75-kilowatt machines, they are now beginning to build 100, 150, 200, 350, and 500-kilowatt machines at costs and with performance that would not have been possible a short time ago.

These new machines, and the multi-megawatt windturbines on which work is underway, represent major steps forward. In the real world of medium-to-large scale hardware, progress does not occur overnight, however. Tooling, manufacturing, financing, installation, and operation take time. It has taken four years to reach today's state. And it is likely to be another four years or so before enough new machines are installed and enough experience is accumulated with them to permit the next steps to fully commercial machines sufficiently inexpensive and well proved to be financed without the energy tax credit.

The substantial R&D and manufacturing investments needed to attain this point are not likely to be made, however, unless the market for both the intermediate and longer-term products appears likely to be vigorous enough to make the investments worthwhile. In the absence of sizeable increases in energy prices, which few of us would welcome, extending the ETC is important to sustaining this favorable and vital market climate.

ENERGY TAX CREDIT EFFECTS

As this detailed example illustrates, the impact of the business renewable energy tax credit is already significant, and is becoming increasingly so. It has proved effective and essential in the financing of economically attractive projects in biomass (e.g., wood and waste fired cogeneration), geothermal energy, and wind energy. And it is a key element of financings being developed for these areas, for low-head hydroelectricity, and for solar process heat and solar-powered electricity generation. For these financings, *the energy tax credit helps transform projects that are merely economic and competitive with oil into ones that* have returns high enough to attract the necessary risk capital.

By helping renewable energy investments to attract risk capital, the ETC has also helped create a "market pull" for private funding of research and development. The expectation that there will be an active market for the ultimate products stimulates well-established firms, young entrepreneurial companies, and venture capital sources to invest in improved products that will be more competitive and might capture significant market share. Evidence of this is the rapid progress being made in wind turbines, in coal-fired cogeneration, in bottoming-cycle low-temperature-difference electric power generation, parabolic trough and dish and fresnel lens high-temperature solar collectors, and in photovoltaics.

Some of the developments have benefitted from Federal R&D support. But much of the most recent progress with which I am familiar stems from private investment attracted by the prospect of a large market. If that market remains strong and continues to grow, investors who have supported successful developments can earn the rewards that will repay them for the substantial risk they have taken and continue to take.

I would like to illustrate the value and importance of the ETC using figures from specific renewable energy projects we have financed or analyzed for financing. To clarify the terms and concepts, I would like first to describe briefly how renewable energy projects are typically financed and what returns are needed in today's financial markets.

Broadly speaking, projects are financed with two general types of funds:

Debt:	money loaned to the project's owners at determined (though not necessarily fixed) rates of interest, with a determined schedule for repayment, the loan is typically secured by credit-worthy guarantees and/or collateral.
Equity:	risk capital invested for a share of the project ownership. Repayment is not guaranteed; the investor can lose most of his money if the project fails. Return on investment is achieved through the tax benefits accruing to the project's owners plus the operating profits left after paying expenses and the principal and interest owed on the debt.

Although interest rates are still relatively high, some debt can generally be obtained for a sufficiently attractive and creditworthy project. Projects viewed as particularly risky -- perhaps because of their technology is new and untried, because they are large, or because their economic returns depend too greatly on governmental actions -- may not be able to obtain debt without guarantees by creditworthy entities.

To obtain equity or risk capital for an energy project today entails competing for investors' funds with a wide range of alternative equity investments. Within a corporation, a project must mesh with overall corporate strategy and compete with other investments open to the firm. For passive investors, institutions or individuals, the project must offer rewards at least as attractive as those available from more conventional investments, and commensurate with the perceived risks.

Today, very high returns can be obtained on relatively conservative and liquid investments; for example, thirty-year A-rated tax-exempt bonds are yielding over 10%. Most project equity investments are comparatively illiquid. Sale of ownership interest before the end of the five-year vesting period for investment and energy tax credits can have adverse tax consequences, and limited partnership interests in general cannot be freely traded. Add to these considerations investors' concerns about the course of future energy prices, and the risk premium noted earlier. As a result, we find that to attract equity investors today, a sound renewable energy project must offer a minimum probable rate of return on equity between 20% and 30% after-tax, and have the possibility that the return could go even higher. (This rate of return is an average annual return over a project's life.) Projects with better established technologies, such as hydroelectric or gas-fired cogeneration, can generally be priced to yield rates of return at the lower end of this range; those with newer technologies tend to require the upper end of the range. In this market environment, the business energy tax credit is a vital element in attracting equity capital for renewable energy projects.

Recently, for example, we raised over $40 million in equity for a series of wind projects (totalling over 40 megawatts) to be constructed in Northern California. The windturbines being used have been operating successfully for over a year and the project management and economics were quite attractive. Based on reasonable estimates of future electricity "avoided costs" in that area, our projections showed a likely return on equity nationally in the range of 23% to 30% after-tax, including the benefits of the ETC. The project equity sold well. Without the ETC, the return on equity with the same projections (adapting the financing structure to the different benefit schedule) would have been only 14% to 15% after-tax. With this lower rate of return, the project equity would not have been an attractive investment; I doubt that investors would have purchased the equity interests, and the projects would not have been financed.

One might argue that, if the return were not high enough without the ETC, then perforce the project must not be competitively economic and should not be built -- that it would divert resources from potentially more profitable ventures. This argument, however, ignores the realities of the marketplace. As we noted earlier, the market today requires a premium rate of return on equity, the project would have a better rate of return than much of American industry, and thus would be a worthwhile investment for the nation. According to "Forbes" 1983 Annual Report on American Industry, for example, a return on equity of 14% to 15% would be at the median for the largest 1,000 firms in the United States and near the median 5-year average return on equity for the energy industry. Moreover, over its life, the project is expected to yield for the Treasury much more in tax revenues than the cost to the Treasury of the tax credits.

To obtain the necessary rate of return in other projects -- where the technology is still new and/or production has just begun, so that costs are still high -- both the Federal ETC and a large state tax credit (such as that in California) have proved essential. For example, a very attractive project to convert solar energy to electricity that we have analyzed in great detail shows a rate of return in California of roughly 30% after-tax; this rate is what will be needed to finance it since the technology is new.

Outside of the very few states having comparable credits, its return with the current ETC falls to roughly 13% after-tax -- higher than Treasury's borrowing rate, but too low to be financed in today's market. Increasing the Federal ETC to 25% for such projects would enable them to be financed in every state having good sunshine -- including, for example, Wyoming, Kansas, Oregon, Louisiana, Texas, and Hawaii, to name only a few.

This solar technology merits this kind of launching assistance. As components are produced in quantity, the costs should decline significantly, attaining levels by 1987-88 that should be financeable without even the 15% ETC. It would then be able to be used everywhere without further assistnce -- but it cannot cross the mountain to reach this valley without ETC assistance at the beginning.

In light of these market realities, the use of a 10% discount rate in calculations concerning the ETC by the Department of the Treasury (in well-publicized correspondence to the Congress) is quite unrealistic. The traditional threshhold (or "hurdle") rate used by corporations to assess investments was 15% after-tax, when inflation was low. Today that rate is more typically 20% to 25%. And for alternative energy investment, as we have noted, 30% is realistic today.

Let us thus redo Treasury's calculation using 30% after-tax as the standard:

(a) The net present value after-tax of the regular investment tax credit (ITC) is 10%;

(b) The net present value after-tax of the Accelerated Cost Recovery System (ACRS) 5-year depreciation deductions, with the TEFRA adjustment for the ITC, is 26.77% for corporations and 29.10% for individuals.

(c) Without the ETC, we thus have the following inequitable results:

TABLE 1: NET PRESENT VALUE AFTER-TAX WITHOUT ETC

	ITC & ACRS	EXPENSING
Corporations	36.77%	46%
Individuals	39.10%	50%

Now let us consider the results with the 15% ETC, again with 30% after-tax as the standard:

(a) The net present value after-tax of the ITC and ETC together is 25%;

(b) The net present value after-tax of the ACRS 5-year depreciation deductions, with the TEFRA adjustment for the ITC and ETC, is 24.66% for corporations and 26.80% for individuals. If the individuals are investing in a limited partnership, under current tax law the partnership's business is assumed to begin only when the project is placed in service, so that only a prorata share of the ACRS depreciation is available in the initial year. In this case (which probably is the most common case for renewable energy financing today), the net present value after-tax of the ACRS depreciation is only 23.30 percent.

(c) With the ETC, we thus have the following results:

TABLE 2: NET PRESENT VALUE AFTER-TAX WITH ETC

	ITC + ETC + ACRS	EXPENSING
Corporations	49.66%	46%
Individuals	51.80%	50%
Individuals in Limited Partnership	48.30%	50%

As Table 1 and 2 clearly show, the business energy tax credit is vital to providing a balanced and equitable tax environment for renewable energy. Extending it to 1990 will help maintain that balance and equitable treatment in the financial markets through the next critical stage of these important technologies' development.

FUTURE MARKETS

Substantial investments are now being made in R&D for renewable energy technologies -- such as solar thermal, photovoltaics, and larger wind turbines -- that should come to market over the next three to six years. And in several technologies, some companies are considering building expensive production lines that could significantly reduce costs. Increasingly, the private sector is investing in these key steps for renewable energy technologies. But it is doing so with the expectation that a worthwhile market will be there.

The ETC is important to assuring that market, and thus to ensuring that these firms will find it attractive to make and to continue these R&D investments. Especially with the major reductions in Department of Energy R&D funding, such continued private investment is critical. Extending to 1990 the current 1985 expiration date for the ETC, and perhaps augmenting the ETC for newer technologies, would provide the kind of investment certainty that the Administration has eloquently argued is so critical in other areas.

To add a quantitative dimension, I would like to offer an illustrative example from studies we have done for photovoltaics. As you know, photovoltaics are widely felt to be one of the most promising renewable energy technologies, with a potential worldwide market approaching several hundred billion dollars. Several of our clients, and others active in photovoltaics, estimate that they can achieve by 1985-1987 photovoltaic systems installed costs of roughly $2.00 per peak-watt of capacity. Such a system cost might include panels costing $0.50 per peak-watt, achieved through large-scale production, and "balance of systems" costing roughly $1.50 per peak-watt, achieved by simplification and serious cost reduction. Such a system, financed relatively conservatively, could achieve the risk rates of return required today with the aid of the ETC.

Consider a system with such a cost, installed in a very sunny area that yields 2.5 kilowatt hours annually per peak-watt of capacity, financed by institutional or corporate investors with

60% equity and 40% debt (with a term of 15 years at 15% fixed-rate interest). Although some forecasts are higher, assume that the price paid for the system's electricity increases 5% per year. We tabulate the electricity price needed in the first year to yield the investors a 25% rate of return on equity after-tax.

The following table shows the value of the ETC for the current-TEFRA adjusted ACRS depreciation schedule:

TABLE 3: ELECTRICITY PRICE (cents per kwh)

With the ETC	Without the ETC
7.6	11.4

As this table shows, extending the ETC would help ensure that electricity from photovoltaic systems would be competitive with electricity from other sources in most parts of the United States by the mid-to-late 1980's. It would thereby help to hold down increases in electricity prices across sunny parts of the nation and reduce costs to consumers for whom photovoltaics would become the preferred supply.

The impact of the ETC is quite significant. It is worth, for systems having a ratio of total cost to annual power production in the range of $0.70 to $1.50 per annual kilowatt-hour (this example used $2.00 per 2.5 kwh or $0.80 per kwh), roughly $0.04 to $0.08 per kilowatt hour. By helping to build a substantial U.S. market for photovoltaics in the mid-1980's, it would assist

U.S. companies to establish a solid production base from which to compete effectively with heavily subsidized Japanese photovoltaic activities in the world market.

FINANCING VALUE

The ETC is so important in equity financing for two main reasons. First, it can be taken by investors in the year the renewable energy equipment is placed in service. For equipment taking over two years to build, it can be taken on a progress basis. It thus is not diminished by the high discount rates investors apply today, and retains a substantial net present value. Depreciation allowances, spread over five years or more, are (as the numbers displayed earlier show) not valued by investors at anywhere near their face value.

Second, a tax credit, unlike a deduction such as the depreciation allowance, does not depend for its value on the marginal tax rate the investor pays. The ETC is worth as much to a small business paying a lower tax rate as it is to a corporation paying the full 46% rate at the margin. It is also worth as much to an individual investor not in the top tax bracket who has funds to invest, as it is to someone paying the top rate of 50%.

The energy tax credit could also be valuable to the natural customers and users of renewable energy -- the utilities, who under current tax law cannot obtain it. PURPA permits utilities to own less than fifty percent of alternative energy projects without jeopardizing the projects' unregulated status. These unregulated, independent power projects are not guaranteed rates of return. And, in at least several states, the utility investment in these unregulated projects is not included in the rate base and tax benefits received by the utility need not be passed directly to ratepayers.

Yet, it is widely felt that utilities participating in these projects are not or will not be eligible to receive the ETC (and may need to take 15-year ACRS depreciation rather than the more favorable 5-year treatment). Clarifying this status or amending the Code, if needed, would open for alternative energy potentially significant investments and participation by utilities. I suggest for your consideration making the ETC and 5-year ACRS depreciation available to utilities that (a) participate as minority owners in projects or ventures that would not be considered public utility property if the utility were not involved, or are not considered public utility property for the non-utility participants, and/or (b) own projects through unregulated subsidiaries or other means not regulated on a rate-of-return basis, where the tax benefits will be left in the project to improve its economics.

CONCLUSION

At its current level, the business energy tax credit is quite important for the financing of renewable energy projects, as I hope the examples presented have helped to show. To continue the stimulus for market-driven, private sector investment in renewable energy R&D, and to continue the increasing pace of renewable energy development and use, extending and perhaps increasing the ETC would be a national investment offering very substantial returns.

Thank you very much. I will be pleased to supply for the record answers to questions the Committee may have.

The American Wind Energy Association

July 15, 1983

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Wayne Van Dyck
Windfarms

Honorable Don Fuqua, Chairman
House Committee on Science and Technology
Subcommittee on Energy Development
and Applications
B-374 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Fuqua:

Enclosed is written testimony presenting the views of the American Wind Energy Association (AWEA) on H.R. 1775, the "Renewable Energy Tax Credit Act of 1983", which we would like to submit for the record of the recent subcommittee hearing on that bill.

We appreciate your continued efforts to help provide a stable and supportive tax environment for the renewable energy industries, as exemplified in H.R. 1775.

Best wishes.

Sincerely,

Thomas O. Gray

Thomas O. Gray
Executive Director

2010 Mass. Ave., NW, 4th Floor, Washington, DC 20036 tel. (202)775-8910

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Wayne Van Dyck
Windfarms

Statement of Thomas O. Gray
Executive Director, American Wind Energy Association
for submission to the
United States House of Representatives
Committee on Science and Technology
Subcommittee on Energy Development and Applications

The American Wind Energy Association (AWEA), which represents manufacturers, component suppliers, and developers in the wind energy industry, appreciates the opportunity to provide its views on H.R. 1775, the "Renewable Energy Tax Credit Act of 1983."

AWEA is the trade association which represents manufacturers of wind energy systems and related equipment. The Association has 89 corporate members at present, ranging in size from General Electric Company and Boeing Engineering and Construction down to small businesses with only a few employees.

We are strongly in agreement with the thrust of H.R. 1775 and join with its supporters in the view that the present energy tax credits, which expire in 1985, will not provide the degree or duration of incentive needed for these emerging industries to realize their full potential. Additionally, we would like to salute Representative Don Fuqua, chairman of the subcommittee, for his consistent leadership on this issue.

However, in addition to extension and enhancement of the business energy tax credit, as provided by H.R. 1775, the small wind systems industry in particular badly needs an extension of the residential energy credit. Such an extension, together with similar language on the business credit, is provided by H.R. 3072, the Renewable Energy Incentive Act of 1983, of which Representative Fuqua is a cosponsor, and we would earnestly commend the broader approach of H.R. 3072 to the subcommittee's attention.

Wind energy is a new/old technology, like a number of others in the renewable energy field.

The mechanical use of the kinetic energy in the wind has been known and applied for thousands of years for such purposes as grinding grain and pumping water.

Using a wind turbine to produce electricity, however, is a much more recent development, dating back only to the early part of this century, and during much of the time that the technology has been in existence, its development has been slowed or stopped entirely by competition from cheaper conventional energy sources such as oil and coal.

For example, although the first utility-scale wind electric system, a 1.25 megawatt machine with a 175-foot-diameter rotor, was built in 1939-41, an evaluation showed that future systems based on

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lessons learned about design flaws."

In the third market, the utility-scale market, wind systems are in a somewhat earlier phase of technical development, with commercial sales still limited to a handful. In large part, this is due to the fact that major projects involving large systems are particularly vulnerable to the type of swiftly changing financial environment and instability in the oil market which we have experienced during the past few years.

In the utility-scale market, machines range from 200 kilowatts to 4 megawatts in size (from 80 to 300 feet in diameter), and even larger systems are under development. It is projected that economies of scale to be realized with these systems once they are in production will bring costs of energy down to a range competitive with conventional energy sources.

The critical need in this market today can be summed up as long-term stability.

Large wind systems are major industrial products, requiring the commitment of many millions of dollars. I believe a viable market for such systems exists, but that determination depends upon improved economics which can only be realized through higher production levels and greater operating experience.

The original intent of the energy tax credits was to provide a "bridge" of support to the point in time where those improved economics would exist. But looking today at an expiration date of the end of 1985, it seems clear that that support will fall short.

More importantly, the fact that we are now beginning to approach the deadline without clearly economical systems in production is deterring capital investment in the large-machine industry right now. A longer "horizon" on the credits would make that investment much more likely, particularly since the economy is beginning to improve again, and companies are again beginning to think about the possibility of expansion.

So this is a crucial period for the utility-scale wind industry. A number of major wind projects are in the serious discussion stage right now. Most of them have been in that stage for several months, and the tax credit extension and enhancement contained in H.R. 1775 and H.R. 3072 would be very likely to provide the small additional boost needed for a decision to go forward.

To fully understand the problems involved in attracting financial support for wind energy, it may be useful to briefly review some of the factors which have affected its financial environment in recent years.

Businessmen, entrepreneurs and investors in the wind industry have labored under extremely difficult circumstances since the energy tax credits were enacted.

the same design would cost $190 a kilowatt installed to construct, compared to a price of $125 a kilowatt for conventional generating capacity, and so no further systems of that size were built until 1978.

Since the passage of the energy tax credits in that same year of 1978, a variety of factors have continued to hamper development of wind electric technology. Among those factors have been: falling oil prices; a depressed economy with high interest rates; a constantly changing tax environment; and technical difficulties in developing simple and reliable equipment, due to the fact that the wind is the most widely variable of the renewable energy sources.

The wind industry can be conveniently divided by market into three parts -- residential, windfarm, and utility. I will discuss each of these briefly in turn.

Residential systems are typically from less than one kilowatt to around 10 kilowatts in size. In rotor diameter, this means from six feet up to about 25 feet. About 30 companies are building systems of this size today.

In 1982, about 2,000 systems averaging about three kilowatts in size, were sold in this market, which appears to be in a period of flat or very slow growth brought on in part by the recent economic downturn. Because sales prospects in this market remain unclear, the potential of an extension of the residential energy tax credit which H.R. 3072 provides is very important to small machine manufacturers.

In the second market, the windfarm market where third-party deals are common, growth has been fairly sizable. About 1,200 units were installed in 1982, averaging about 40 kilowatts in size with a range from 15 kilowatts to 200 kilowatts (33 to 80 feet in rotor diameter). To give you some idea of the size of wind energy in our economy, the windfarms totalled about 50 megawatts at the end of 1982, compared to national utility capacity of about 470,000 megawatts. Twenty to 30 companies are building equipment of this size.

The quality and price of systems in both the residential and windfarm markets are steadily improving, in the windfarm market partly because of domestic competition and partly because of strong competition from Danish, Dutch, Swiss and Canadian imports. Further improvements can be expected if the tax credits are continued.

One recent indication of this improvement is a study presented by the National Rural Electric Cooperative Association (NRECA) at the recent Sixth Biennial Wind Energy Conference and Workshop in Minneapolis, MN. That study, a survey of about 110 owners of wind systems interconnected to rural electric cooperative lines, found that "down time", or the percentage of time a machine is idled for maintenance or repairs, declined sharply for systems installed in 1982 (about 10%) as opposed to those installed in 1979 (60-70%) due apparently "to improvement in...manufacturing and...incorporation of

First, the economic recession from which our country is only now recovering has created problems for many industries, including wind.

Second, owing to an unforeseen slackening of demand across the economy, oil prices have weakened dramatically, causing the cancellation of a number of major renewable energy projects for which financial planning was based on steadily rising costs for conventional fuels.

Third, the favorable investment climate which was supposed to have been created by the energy tax credits for wind energy has been drastically altered by a number of events: long delays by the Internal Revenue Service in issuing rules to implement the energy tax credits; attacks by the Department of the Treasury on the business energy credit on two occasions in the last two years; depreciation changes in the Tax Equity and Fiscal Responsibility Act of 1982 which reduced the value of the credits; a threat early this year to lengthen the depreciation period for property used for small power production; and changes in the tax treatment of that property which are now being discussed as part of the Governmental Leasing Tax Act of 1983.

In short, almost since these incentives were initially provided, their impact has been weakened by a number of factors, none of which has any relation to the inherent value of these technologies.

We continue today to have the same national interest in achieving energy independence and in the development of renewable energy technologies as we did four years ago when these incentives were first provided.

I see nothing to suggest that this situation will change in the foreseeable future. Imports still account for a substantial portion of our energy consumption, and will likely continue to do so for many years to come. With continuous unrest in the Middle East, the national security implications of this unhealthy dependence remain a serious concern. We must begin now to build for the future.

One measure of the potential impact which renewable energy technologies can have on that future is provided by a 1982 report from Resource and Technology Management Corporation, which develops comprehensive data on new energy sources and their market growth.

According to the report, renewable energy (including hydropower and direct combustion of wood) will contribute about 8.25 percent of this nation's energy supply by 1985 compared with 7.1 percent in 1980. This 1.15 percent increase amounts to about 125 million barrels of oil saved per year, and will bring the total energy savings from renewable sources by 1985 up to 1.16 billion barrels per year.

Given the proper environment of incentives, I believe considerably greater growth can be achieved by these technologies -- growth which will more than repay to the Treasury and to our nation any revenue loss which results in the short term. Renewable energy businesses will pay taxes in future years, both on sales of equipment and on sales of electricity to the utility grid. In addition, business fuel write-offs for conventional fuels will be reduced, thereby supplying the Treasury with an offsetting source of revenue.

We therefore strongly urge the subcommittee to support both the extension and enhancement of the business energy credit provided by both H.R. 1775 and H.R. 3072, and the residential credit extension provided by H.R. 3072.

STATEMENT OF
ARCO SOLAR INDUSTRIES

SUBMITTED IN CONNECTION WITH HEARINGS
HELD ON JULY 12 AND JULY 21, 1983
BY THE SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS
OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

ON

TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

ARCO Solar would like to state its views in support of Congressional efforts to extend tax credits for all productive renewable energy sources; in particular, we agree with the importance of preserving and enhancing the tax credit for commercial technologies, such as photovoltaics.

The success of federal efforts with the private sector in photovoltaic research and development has resulted in the world leadership of U.S. companies in the renewable energy industry. Enactment and enhancement of the tax credits for the photovoltaic industry, today, would facilitate development of its market worldwide and help assure U.S. commercial leadership in this critical technology. In this regard, we wish to underscore the usefulness of incentives for early commercial installation and use. These give producers and users both of new technologies the best opportunity, under controlled conditions, to attain comparative advantage on the product learning curve by allowing highly focused, cooperative efforts.

Photovoltaics are increasingly recognized as one of the most promising renewable energy technology. Substantial price reduction and market growth have characterized the technology over the past few years. We expect equally dramatic progress before 1990. Foreign competition, however, has begun to challenge U.S. producers; today, foreign producers, inevitably government-supported, account for 40 percent of world market sales.

Net cost reduction is the key to further commercialization of photovoltaic technology in the U.S. and in turn to U.S. success in the world market. Successful exports have almost always been preceded by domestic market success. In our view, enhancement of tax credits for photovoltaic installations in the U.S., with additional incentives for domestic producers only, would constitute an effective competitive policy for the domestic industry in the world market.

Price effective competition at home, driven at first by focused tax incentives, would lead to market growth, on-line operational experience, customer acceptance and technological development, and in turn result in a competitive product worldwide as foreign customers recognize and then repeat U.S. market acceptance of the technology produced in the U.S.

To put this international competitive strategy in place, we recommend the following:

- o increase the federal tax credit from 15 to 30 percent for renewable energy systems and extend the credit for five years;
- o limit the additional 15 percent credit to photovoltaic products manufactured in the U.S.;
- o extend the availability of the credit to public utilities, who after all will be one of the critical entities directly involved in bringing the benefits of this new technology to the consumer;
- o allow the credit to be taken where "subsidized loan funds" are involved in the transaction, such as revenue bonds and Rural Electrication Administration loans.

We believe the benefits of such a coherent approach to the market development of photovoltaic technology at home and abroad will far outweigh the costs of the U.S. Treasury (demonstrably small given the fledging size of the industry). Conversely, the costs of a domestic photovoltaic industry falling stillborn to foreign competitive strategies are obvious in terms of future employment opportunities lost and another U.S. failure in the realm of international technological competition for the products and markets of the future.

Implementation of farsighted and focused policy now will promote economic activity in a new, job creating commercial technology, as well as provide for an indigeneous, environmentally benign source of additional electrical generation for the country, which can be added to the existing power grid on an incremental, appropriate-scale basis. Such a policy also offers the best prospect of maintaining a positive balance of trade in viable renewable energy technology and products. Rapid industry growth at home is a necessity now, if significant benefits are to materialize for the U.S. in the world market by the late 1980s and early 1990s.

We appreciate this opportunity to present our view.

7/27/83

WRITTEN STATEMENT OF
McDONNELL DOUGLAS ASTRONAUTICS COMPANY

HEARING ON
TAX INCENTIVES FOR NEW ENERGY TECHNOLOGIES

Submitted to the
SUBCOMMITTEE ON DEVELOPMENT AND APPLICATIONS
of the
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES

July 21, 1983

SUMMARY

McDonnell Douglas Astronautics Company has been actively engaged in the development of solar central receiver technology for the last 10 years. This has involved basic engineering, manufacturing of prototype heliostats, research, and economic and technical analysis aimed at commercializing solar thermal central receiver technology in the United States. Our principal interest has been to develop a market for the commercial use of heliostat hardware (two axis tracking mirrors), a principal component of solar central receiver plants. We believe our interests are typical of solar suppliers for major plants. To illustrate the situation, we will discuss a specific proposed plant.

At the present time, McDonnell Douglas is proposing to construct a 100 megawatt solar central receiver project, Solar-100, in the Lucerne Valley of California on a site owned by Southern California Edison Company (SCE). If SCE and McDonnell Douglas can agree to go forward with this project within the next six months, and the California Public Utilities Commission approves of the various contractual arrangements that need to be reviewed by it, final design and initial construction can commence in 1984. If construction commences in 1984, the first half of the plant is scheduled to come on line by December, 1987, and the second half of the plant will come on line by December, 1991.

The project involves significant risks and costs in commercializing a new technology involving large heliostats, a molten salt heat transfer system, and various other equipment that have not been used before. Because the initial capital costs and risks are very high, and the pay back period as well as the rate of return well below normal corporate hurdles, financing by unaffiliated third parties is not feasible and the project can only be financed by funding from affiliated equipment suppliers. If the energy tax credits are not available, McDonnell Douglas and other affiliated suppliers will not participate in this project. We are considering this investment principally because of our belief that a future market for the purchase of solar central receiver plants by utilities may develop. McDonnell Douglas and the other equipment suppliers to Solar-100 could become the providers of goods and services in that market.

This project alone will create more than 6700 man-years of jobs in the next 35 years and reduce the importation of oil by 800,000 barrels per year at a savings of $24 million a year (at oil priced at $30 a barrel). Not only will these jobs and savings accrue if the project is successful, but other jobs and further savings will occur if the technology is commercially demonstrated and the other plants built. Additionally, there are significant opportunities for export of this technology to other countries, further assisting the U.S. balance of payments.

This project is on the drawing boards right now. In the next few months, decisions need to be made and millions of dollars of funds committed to make this project go forward. We cannot commit these funds and make these decisions to go forward without the passage of legislation now before the House Ways and Means Committee (H.R. 1884, H.R. 1372 or H.R. 3358) allowing us to take the energy tax credits for this project.

BRIEF HISTORY

The progress to date in the development of solar central receiver technology has been characterized by a cooperative effort by the Federal government, a number of electric utilities, and a number of companies like McDonnell Douglas Astronautics, that have been keenly interested in participating in the development of a market for the equipment that can efficiently use the sun's energy for large scale commercial power production.

Solar One

Through the involvement and support of the Congress and the Department of Energy over the last 10 years, there are several significant events heralding the development of the solar central receiver as a viable energy source for electric generation in the United States. These events culminated on April 12, 1982, when a 10 megawatt solar central receiver pilot plant near Barstow, California, became operational and on November, 1982, when the facility was dedicated. (See attached photo.)

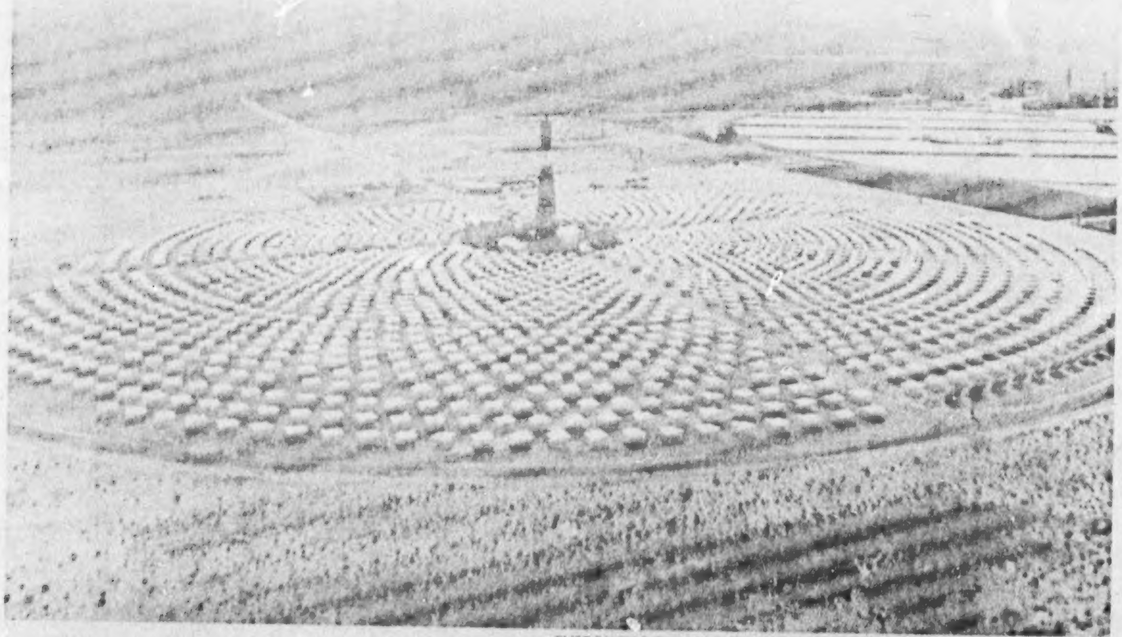
This plant, known as Solar-One, is undergoing a 5-year test program. It is currently the world's largest electric generating station being successfully powered by solar energy.

Solar-100

Last year, as a follow up to the research and development that has been invested in Solar-One and the expertise gained thereunder, Southern California Edison requested proposals from private industry for the development of the first commercial scale solar central receiver plant at SCE's Lucerne Valley site in California's Mohave Desert. Four companies, including McDonnell Douglas Astronautics, responded to the SCE request and expressed confidence in the technologies that are available and optimism that financing can be worked out.

Southern California Edison has been a utility leader in demonstrating interest in renewable energy resources generally, with a commitment to develop as part of its power generating facilities, 2100 megawatts of renewable energy resources by the early 1990's. Of this amount, 890 megawatts have been designated to come from solar energy. In addition, there is strong interest among other utilities in the Southwest to participate in more than 49 follow-on, 100 megawatt, central receiver plants for capacity additions by the year 2000.

Pursuant to a more recent request of SCE for offers to build a solar central receiver power plant at this site, we have submitted an offer to SCE on June 10, 1983, and hope to begin negotiations with SCE in the next few weeks. Attached to this statement is a design concept illustration of our proposal.



ENERGY PROGRAMS MCDONNELL DOUGLAS ASTRONAUTICS COMPANY

SOLAR-100 PROGRAM SUMMARY SCHEDULE

A schedule summarizing the major milestones in the development of Solar-100 is also attached to this statement. Even if we are able to initiate final design and begin construction of the plant in early 1984, the first half of the plant will not become operational until early 1988. The final design, site preparation, civil, mechanical and electrical work will take approximately four years to complete. Following check out of this facility, the second half of the plant will not come on line until late 1991 or early 1992, if initiated in 1989. Therefore, the complete Solar-100 plant will take approximately eight years to bring on line, from the beginning of the final design and construction to the placing in service of the last of the 10,000 heliostats and other associated equipment.

Enactment of H.R. 1884, H.R. 1372 or H.R. 3358 would allow us to receive the energy tax credits for energy property placed in service prior to the end of 1992. The schedule for completion of the Solar-100 project demonstrates the importance of extending the availability of the energy tax credit in order to allow investors in this project to receive the benefits of the credit.

PROJECT REVENUE IMPACT

The project costs to build this commercial demonstration plant are going to be in the hundreds of millions of dollars. SCE has told us that it would buy energy from an independent power producer which would own the plant, rather than own the entire plant itself. Hence, the required capital investment must come from non-utility sources like ourselves if the project is to go forward.

We estimate that over the eight-year construction life of the full Solar-100 Project, there will be approximately $80 million in energy tax credits available to project sponsors. We also estimate that there will be tax revenues generated to the Treasury, both during this construction period and over the 30-year life of the plant, of between $800 million and $2.5 billion. At $30 a barrel, this solar plant will displace the need to import $24 million worth of foreign oil a year into the United States.

The energy tax credits would appear to us to be a worthwhile investment by the Congress to foster this technology. The returns to the U.S. Treasury over the life of the project are far greater than the amount of the credits. Without the credits, our analysis shows that returns to project participants are reduced by 32% and funding and credit support levels will be increased by 20%. This makes the funding of the project unacceptable to ourselves and others who would like to go forward with us. Additionally, without the credits, the payback period is an unacceptably long 17 years.

PROSPECTS FOR COMMERCIAL DEPLOYMENT OF THIS TECHNOLOGY

If this project proves to be a commercial success, we believe that we could build as many as six plants by the year 2002, and 35 plants in California alone by the year 2020. In order for the Committee to appreciate where other future plants may be sited, we are attaching a solar insolation map. This map identifies the regions of prime interest for utilization of solar central receiver technology. Stretching from Texas in the East to California in the West and as far north as the southern half of Idaho and Wyoming, there are vast quantities of available land and sunlight for development of solar central receiver electric generating plants throughout the western United States.

JOB IMPACT

The jobs created by the development and deployment of this technology are not limited to the Lucerne Valley site. Attached to this statement is an abbreviated list of the potential industrial and engineering firms which may be involved with us in the design and construction of this project. Over 400 firms, both large and small, are potential suppliers of goods and services to this project and, although the project will be located in California, these firms are located throughout the United States.

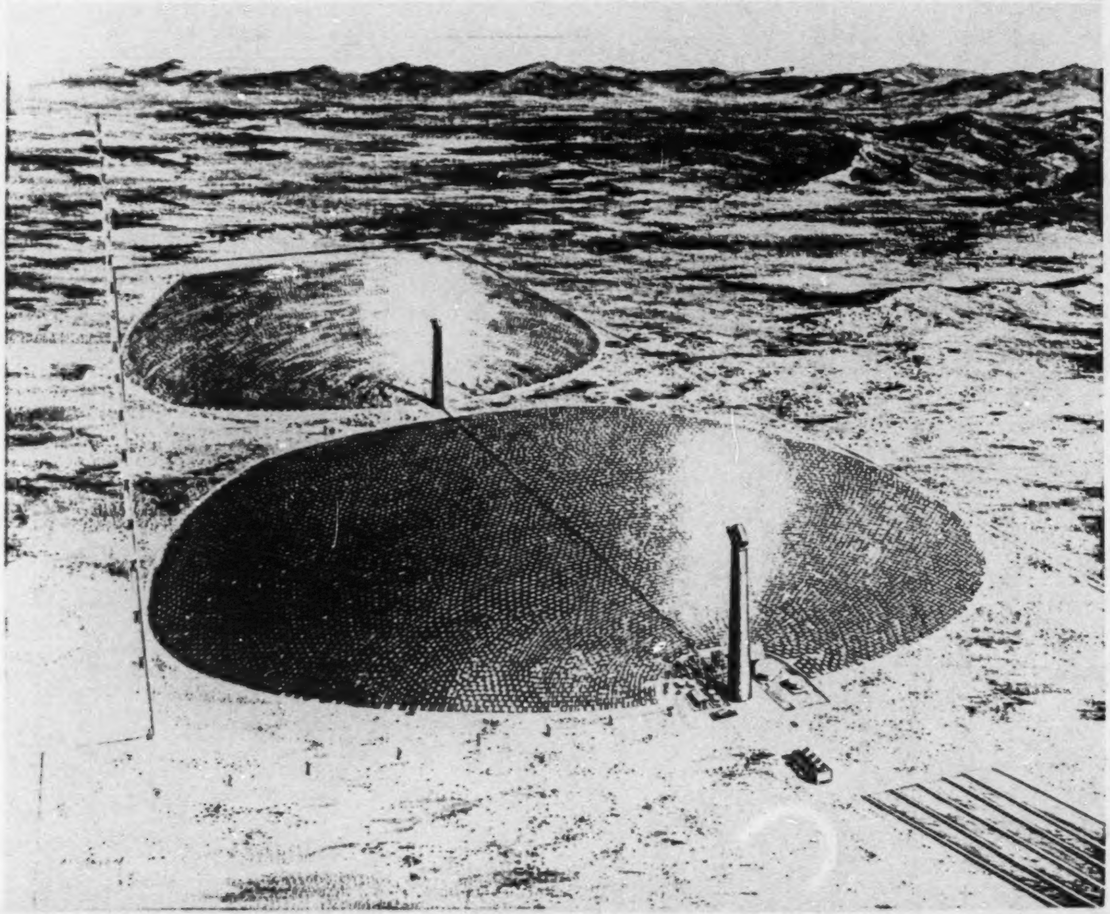
In terms of jobs in plant operations and the manufacturing and construction sectors of the economy directly related to the project, we estimate that the first plant will result in 6700 man-years of employment. If this technology proves commercially viable, we will have created an industry employing thousands of U.S. workers well into the 21st century. Instead of importing foreign oil, this project will result in the employment of hundreds, if not thousands, of U.S. workers to help make our nation become self-sufficient in its energy needs.

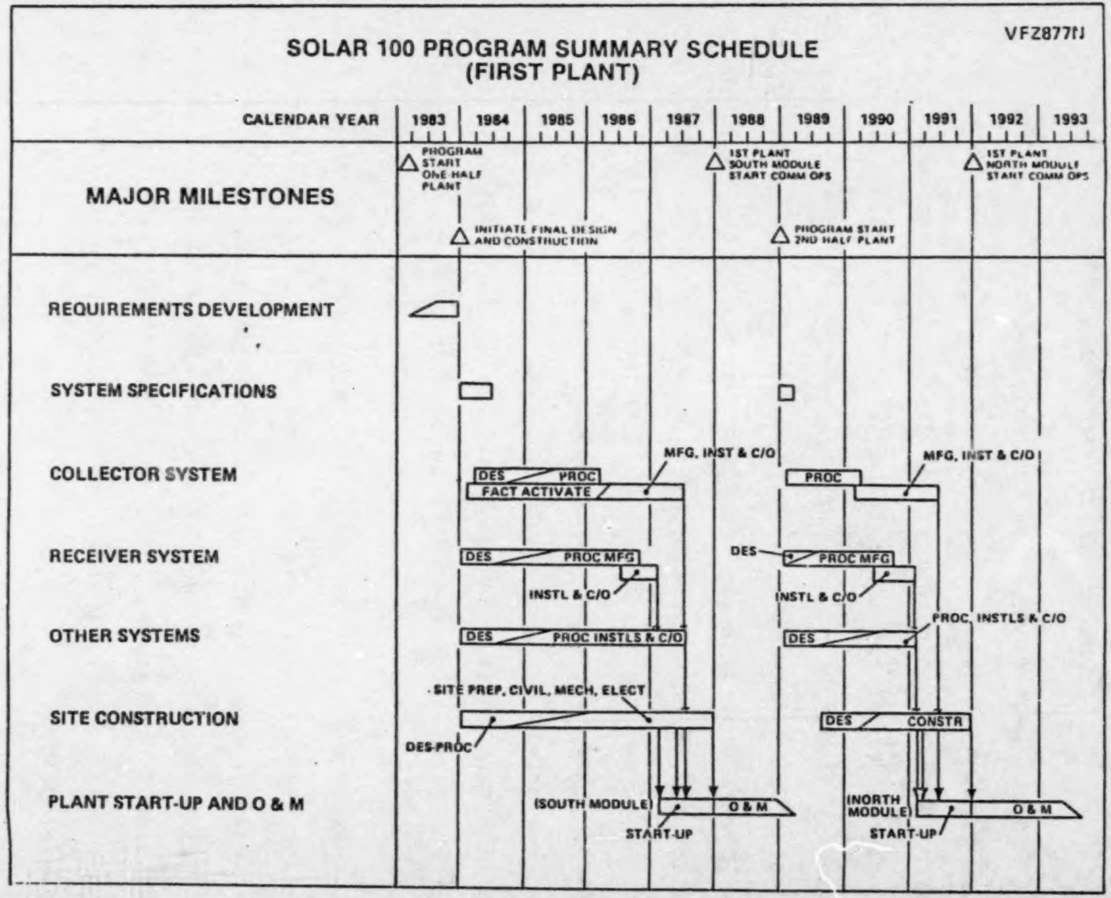
FOREIGN COMPETITION

There are six operating central receiver solar facilities in the world today. The list is as follows:

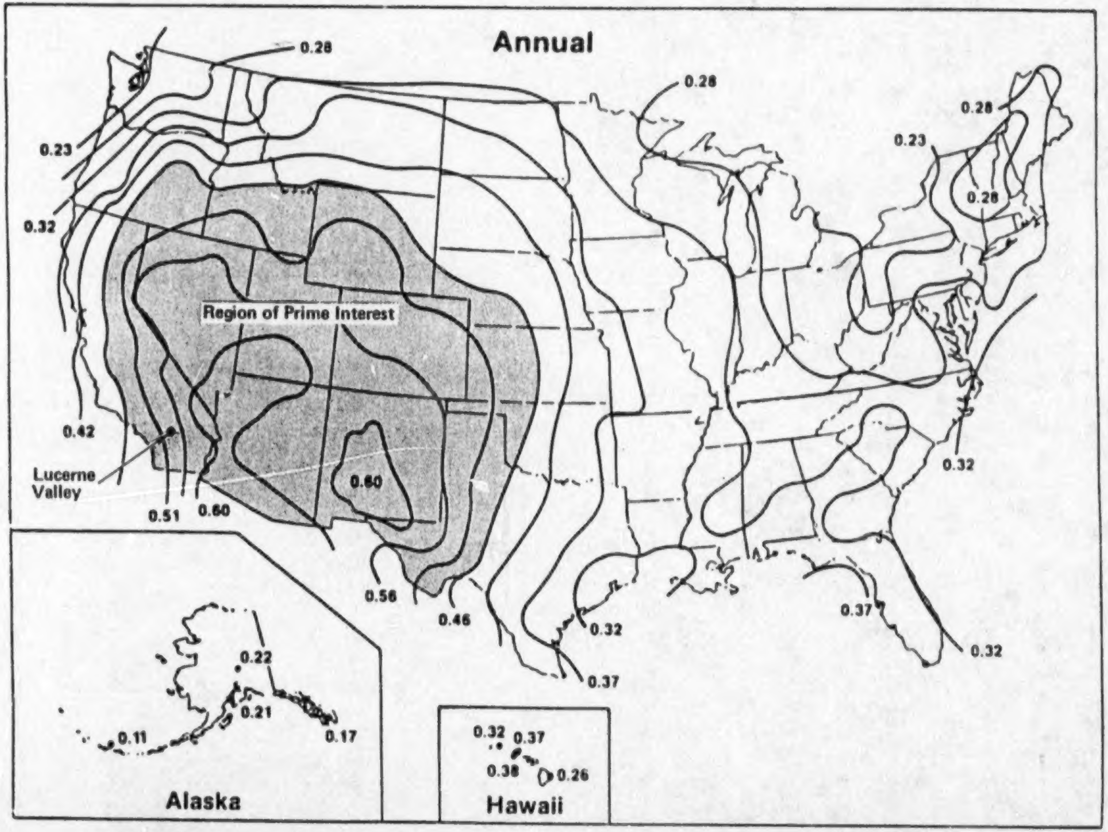
OPERATING CR SOLAR FACILITIES

Central Receivers	Size MWe	Operational
Barstow Solar One	10	4/82
ARCO Enhanced Oil Recovery	1	1982
IEA, Almeria, Spain	0.5	9/81
Sunshine Project, Japan	1	9/81
Eurelios, Italy	1	6/81
Themis, France	2.5	8/82





SOLAR 100 PROGRAM SUMMARY SCHEDULE (FIRST PLANT)


Annual
0.28
0.23
0.32
Region of Prime Interest
0.42
Lucerne Valley
0.51
0.60
0.60
0.56
0.46
0.28
0.28
0.23
0.28
0.32
0.32
0.37
0.37
0.32
0.32
Alaska
0.22
0.21
0.11
0.17
Hawaii
0.32
0.37
0.38
0.26

Yearly Average Direct Normal Irradiance I (in kW/m²) During Daylight Hours for the United States.

Reference: SERI/TR-631-716

JOBS RESULT FROM A NEW TAX-PAYING, EXPORTING INDUSTRY BENEFITING MANY STATES

VGC770N-1

PRODUCT	APPROXIMATE DOLLAR VALUE (1983 10^6 \$)	POTENTIAL U. S. SUPPLIERS	SUPPLIER LOCATION
HELIOSTATS			
LAMINATE MIRRORS	20	BINSWANGER	CHANDLER, AZ
		BUCHMIN INDUSTRIES	REEDLEY, CA
ROLL FORMED BEAMS	12	VAN HUFFEL TUBE	WARREN, OH
		BINKLEY	WARRENTON, MO
MAIN BEAM	6	WESTERN GEAR	EVERETT, WA
DRIVE HOUSING	6		
PEDESTAL	4	ACE BUHLER	ANAHEIM, CA
LINEAR ACTUATORS	9	DUFF-NORTON	CHARLOTTE, NC
HARMONIC DRIVE	15	USM CORP	WAKEFIELD, MA
HELICAL GEAR SET	1	ILLINOIS TOOL WORKS	CHICAGO, IL
MOTORS	3	EMERSON ELECTRIC	ST. LOUIS, MO
BEARINGS/BUSHINGS	–	McGILL	VALPARAISO, IN
MICRO PROCESSOR	–	SARGENT INDUSTRIES	BURBANK, CA
CONTROLLER COMPONENTS	–	DIVERSE CANDIDATES	
FACTORY EQUIPMENT	8	ITT CANNON	SANTA ANA, CA
		F. JOS. LAMB CO.	WARREN, MI
		DOLLAR ELECTRIC	MADISON HEIGHTS, MI
ASSEMBLY	82	McDONNELL DOUGLAS	SOUTHGATE/LUCERNE VALLEY, CA
RECEIVER	35	FOSTER WHEELER	DANSVILLE, NY
		ROCKETDYNE	CANOGA PARK, CA
STEAM GENERATOR	9	FOSTER WHEELER	MOUNTAINTOP, PA
		BABCOCK & WILCOX	BARBERTON, OH
PLANT CONTROLS			
COMPUTERS	0.5	DIGITAL EQUIPMENT	BOSTON, MA
		MODCOMP	FT. LAUDERDALE, FL
		HEWLITT PACKARD	PALO ALTO, CA
		BECKMAN	FULLERTON, CA
PROCESS CONTROL	5	LEEDS & NORTHRUP	NORTH WALES, PA
		FORNEY	HOUSTON, TX
		FOXBORO	FOXBORO, MA
SALT TANKS	10	PITTSBURGH DES MOINES	PITTSBURGH, PA
$KNO_3/NaNO_3$ SALT	25	VERTAC CHEMICAL	VICKSBURG, MI
		OLIN CHEMICAL	LAKE CHARLES, LA
SALT MAKEUP SYSTEM	3	OLIN CHEMICAL	STAMFORD, CT
TURBINE	12	GENERAL ELECTRIC	LYNN, MA
OTHER PROCESS EQUIPMENT	33	DIVERSE CANDIDATES	
CONSTRUCTION MATERIALS AND EQUIPMENT	81	DIVERSE CANDIDATES	

As you can see, many of our foreign allies and trading partners are actively engaged in the development of this technology. Importantly, our foreign competitors are receiving significant governmental assistance in their efforts. As of today, with the assistance and foresight of the Congress and the Department of Energy, we are the world's leader in developing solar thermal energy. To maintain this lead and open up opportunities to compete effectively against foreign competition in world markets for the sale of these powerplants, we need to commercialize this technology as quickly as possible. We cannot afford to delay or cancel the initiation of promising projects, such as Solar-100, by reason of the expiration of the energy tax credits.

RISKS AND BENEFITS ATTENDING THE DEVELOPMENT OF SOLAR THERMAL TECHNOLOGY

It is important for the Committee to understand the nature of the risks and benefits involved in developing this technology on a commercial basis. To date, the Federal government has invested more than $140 million in Solar-One to prove the technical feasibility of the basic design for solar central receiver power plants. To move from this research and development phase to the commercial demonstration phase, some additional large scale subsystem development is required.

The thermal storage system in a solar central receiver plant must have the capability of efficiently storing heat energy. In our proposal to SCE for Solar-100, we have designed a molten salt energy transfer and heat storage system which would allow approximately 8 hours of energy to be stored. This would permit the power plant to operate at night and during cloud transients, without significant losses in efficiency. It would also allow excess energy to be stored for later use by the power plant.

Additionally, the heliostats or computer-controlled, sun-tracking mirrors will be dramatically enlarged to achieve commercial scale economics. Research and development in heliostat technology has taken place over more than ten years, starting with 13 square meter mirrors pioneered by McDonnell Douglas for the National Science Foundation. For these reasons and many others, Solar-100 is able to utilize technology advances, but it also involves technical risks. We are optimistic, however, that they can be dealt with successfully.

Our desire to participate in this project and assist in the commercialization of this technology stems from our belief that solar thermal technology can be an economically competitive energy source for the nation's utilities in the decades ahead. Jobs are created for U.S. workers, and foreign oil displaced, thereby improving our balance of payments. Significant environmental benefits are achieved through deployment of the non-polluting, clean source of electric power generation. In that no combustion process is involved, there are no air or water pollution or residual solid wastes disposition concerns.

We would prefer to be solar power plant suppliers as opposed to owners and operators of solar power plants, but we recognize that to commercialize this technology and make purchases of these plants acceptable to utility planners, we have to take significant risks on this first commercial demonstration plant. McDonnell Douglas and other industrial concerns are willing to invest significant funds in developing this technology. We cannot afford to do so without the availability of the energy tax credits.

CONCLUSION

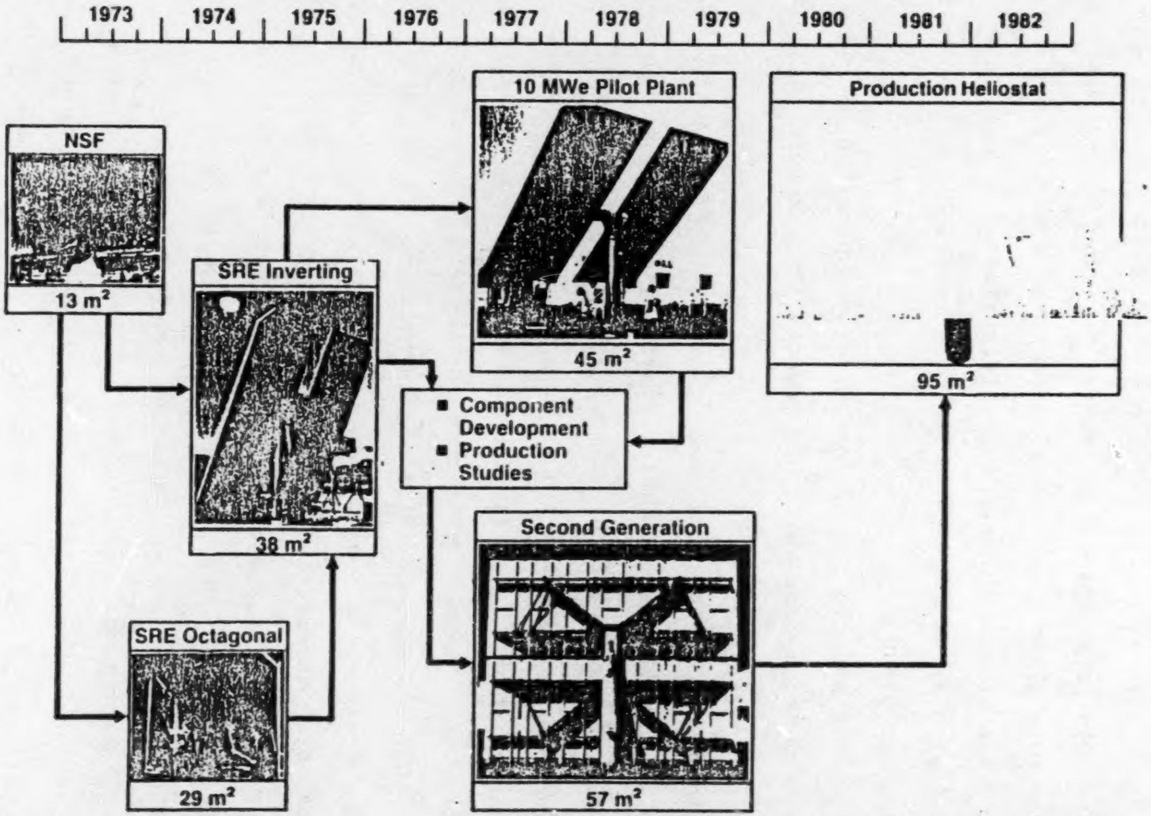
The solar central receiver technology which McDonnell Douglas and others are trying to develop is a first of its kind, high risk, high initial cost technology which, if demonstrated, will provide significant benefits to the U.S. economy. Because of the low return on investment and the long pay back period, funding by disinterested third parties is not available and the funds and credit support required for the project must come from project participants who stand to benefit if the technology meets performance specifications and utilities become willing to purchase future solar thermal plants. The willingness and ability of participants to proceed is stretched to the limit with the energy tax credit available -- without the energy tax credit, this project will not go forward.

The Science and Technology Committee has lead the way in encouraging and supporting the development of renewable energy resources. The research and development program which this Committee authorized several years ago to develop solar thermal applications will pay off enormously with the construction of Solar-100. However, without enactment of legislation which will extend the duration of the energy tax credits for solar, we cannot proceed. Now is not the time to allow for the expiration of the solar energy tax credits, just when private industry is confident that our nation's R&D efforts should be commercialized by the private sector.

○

MDC HELIOSTAT DEVELOPMENT

VFU807N-1


1973
1974
1975
1976
1977
1978
1979
1980
1981
1982

NSF
13 m²

SRE Octagonal
29 m²

SRE Inverting
38 m²

10 MWe Pilot Plant
45 m²

- Component Development
- Production Studies

Second Generation
57 m²

Production Heliostat
95 m²